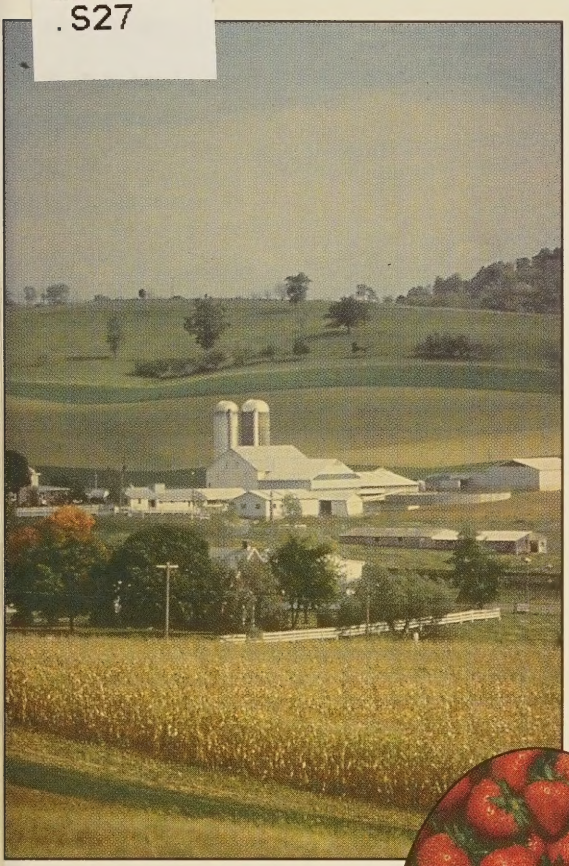
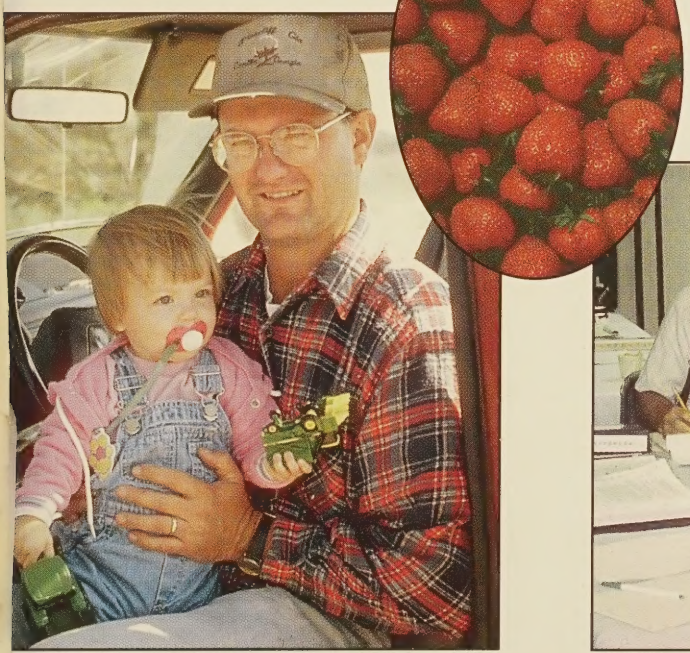
1994 Annual Report

SARE/ACE

Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
SOUTHERN REGION





1994 Southern Region SARE/ACE Annual Report

Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
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SARE was initiated in 1988 and is currently authorized under Chapters One and Three, subtitle B of title XVI of the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA) to promote research to expand knowledge about sustainable agriculture systems. ACE was started in 1991 when the USDA and the EPA cooperated in a new grants program similar to SARE but with an emphasis on pollution prevention.

The Southern Region consists of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virginia and the U.S. Virgin Islands.

The SARE/ACE Program does not discriminate on the basis of race, religion, national origin, sex, age, handicap or veteran status.

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Printed on recycled paper

Cover photo credits

Front cover:
Farm landscape courtesy of *Progressive Farmer Magazine*

A graduate student collects data for Project LS91-37 in Blacksburg, Virginia. The six-year whole farm system project has offered study opportunities for many such graduate students at Virginia Tech. Photo courtesy of Dr. Vivian Allen.

Steve Collins, a fifth generation farmer on both sides of his family, considers time spent with daughter Kathryn one of the benefits of working at home. Photo by Doug Collins, Ft. Valley State College Agricultural Cooperative Extension Agent in Long County, Georgia.

Strawberries are a high value alternative crop of increasing importance. Photo courtesy of *Progressive Farmer Magazine.*

Technical Committee members deliberate the merits of a proposal before voting during a meeting in Atlanta. Photo by Gwen Roland.

Back cover:
Pumpkins are proving to be a profitable crop for diversifying traditional farms. Photo courtesy of *Progressive Farmer Magazine.*

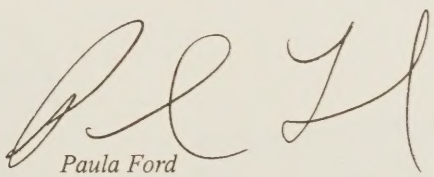
Executive Summary

The preeminent challenge currently facing agriculture is the development of strategies and technologies that, not only fulfill the food and fiber needs of a rapidly growing and urbanized population, but also enhance the natural resource base upon which the agricultural economy depends and improve the quality of life in both rural and urban communities. The concept of sustainable agriculture was formulated to integrate all of these goals. Sustainable agriculture provides a focus and framework in which holistic production decisions can be developed, tested and evaluated. While still evolving in both concept and practice, sustainable agriculture research and education can furnish the vital information that is needed to guide farmers, consumers, researchers, educators and policy makers in the sustainable use of our human, agricultural and natural resource bases.

The mission of the Southern Region SARE/ACE program is to promote and fund research and education activities that will increase knowledge and extend information about sustainable agricultural systems. The Southern Region SARE/ACE program accomplishes this mission by funding research projects that investigate the scientific basis for sustainable agriculture; education projects that expand and extend our knowledge of sustainability to farmers, consumers, researchers, educators and policy makers; and producer-initiated grants that recognize that farmers are innovators and repositories of knowledge about sustainable agriculture.

Research, education and Extension training projects funded by the SARE/ACE program address a broad range of issues currently facing sustainable agriculture, including (but not limited to): sustainable vegetable production, utilization of agricultural and municipal wastes in crop production, biological pest control, and decision support systems for integrated farm management. All of these projects are interdisciplinary, inclusionary, and are carried out by a partnership that includes farmers and ranchers, researchers, Extension personnel, and governmental and non-governmental organization representation.

This partnership philosophy also guides the regional Administrative Council, which acts as the governing body of the SARE/ACE program. The Administrative Council appoints a Technical Committee for proposal review, establishes funding priorities, selects projects for funding and reviews the funded projects to ensure project accountability. Changes in the Administrative Council in the past year include the addition of four additional farmer/rancher members, two additional non-governmental organization members and one member with quality of life expertise. With these new members, the Administrative Council reflects and is representative of the diversity of sustainable agriculture in the Southern Region.



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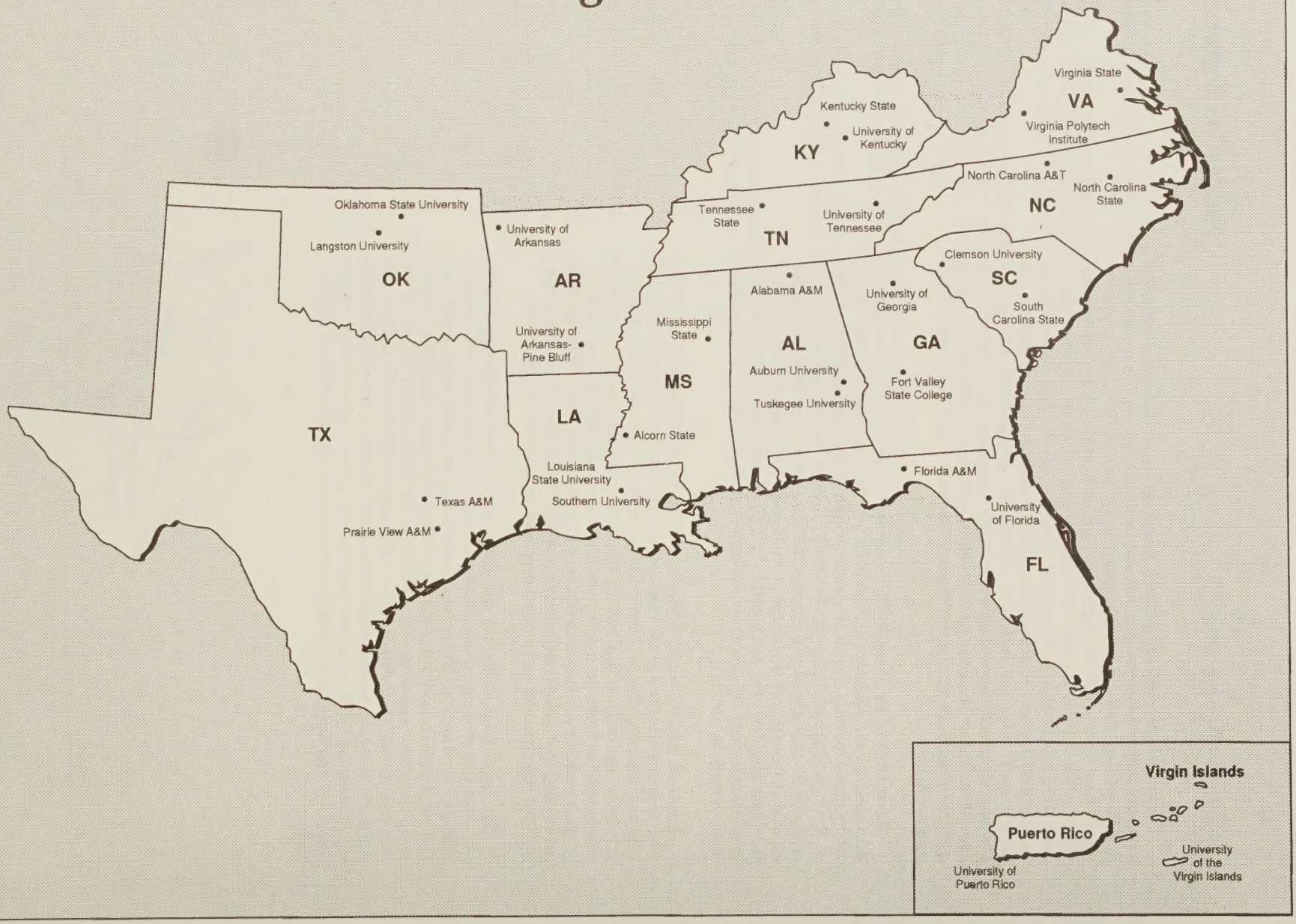

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Program Goals and Mission

The mission of the Southern Region SARE/ACE program is to stimulate research and education activities that will increase knowledge and extend information about sustainable agricultural systems. The Southern Region SARE/ACE program accomplishes this mission by funding research projects that investigate the scientific basis for sustainable agriculture; education projects that expand and extend our knowledge of sustainability to farmers, consumers, researchers, educators, and policy makers; and producer-initiated grants that recognize that farmers are innovators and repositories of knowledge about sustainable agriculture.

In order to fulfill this mission the Southern Region has identified five central goals to guide future activities. These goals include:

Participation - Develop research and education programs that are participatory and promote partnerships between clientele and user groups interested in issues of agricultural sustainability.

Integration - Promote integrated research and education projects through interdisciplinary and inclusionary activities focusing on the long-term viability of the food and fiber system, natural resources and the agricultural producer and consumer.

Communication - Develop a communication system that effectively disseminates project information to a broad demographic and geographic audience, utilizing both traditional and non-traditional forms of communication.

Coordination - Coordinate SARE/ACE activities with programs, both governmental and non-governmental, that have similar missions and objectives.

Evaluation - Develop evaluation procedures that are responsive to the needs and requirements of federal guidelines and SARE/ACE guidelines, while simultaneously assuring the highest scientific quality of projects and equitable treatment and fairness to all interested participants..

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Organizational Structure

In the SARE/ACE Program, Congress decides the amount of funding to be distributed in the Southern Region. The Regional Administrative Council determines the process by which the funding is administered. Additionally it oversees open competition and fair distribution. Each member serves for three years, after which they may be nominated for successive terms. In striving for fair distribution the Administrative Council represents a cross-section of sustainable agricultural experts from governmental and non-governmental agencies, individual farmers and other producers, researchers from all disciplines, agribusiness professionals and educators.

As in the other regions, the Southern Region Administrative Council is responsible to the Secretary of Agriculture through the CSRS-ES partnership. The specific responsibilities are to appoint a regional Host Consortium and a coordinator, make recommendations to the National Sustainable Agriculture Advisory Council (NSAAC) concerning projects that merit funding, promote sustainable agriculture research and education projects, establish criteria for project selection, appoint the Technical Committee for evaluation of proposals, review and act upon the recommendations of the Technical Committee, and prepare an annual report of activities.

Researchers, Extension agents, non-governmental organizations and farmers write grant proposals seeking funding for sustainable agriculture research and education projects. The Technical Committee evaluates the proposals and then advises the Administrative Council of their choices. Appointed by the Administrative Council, Technical Committee members also serve a three-year term. They are chosen for their demonstrable expertise in the area of sustainable agriculture. Like the Administrative Council they can be researchers, Extensionists, producers or educators. Besides evaluating proposals, they also participate in project and program reviews and work with the Administrative Council and the Host Consortium to develop evaluation procedures and guidelines.

After the Administrative Council votes on the projects suggested by the Technical Committee, it directs the staff at the Host Consortium in distributing funds to designated projects. Specifically, the staff negotiates the subcontracts between the researchers and the USDA under the direction of the Administrative Council. The staff processes the grant payments to the projects and maintains records of project expenditures, both funded and in-kind contributions. The staff also maintains documentation of the duration of the project, including annual reports, photographs, publications and other tangible records produced by the participants. As the projects mature, the results are disseminated to the agricultural community by the staff so that producers and researchers who did not receive project funding that year will receive information from the projects that were funded. This dissemination of results takes the form of press releases, newsletters, brochures, electronic mail and the Annual Report to Congress.

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Management Accomplishments

Proposal and Project Management

* Developed 1994 and 1995 Call for Proposals and evaluation guidelines for Research and Education projects and Producer-Initiated Grants.
* Coordinated proposal review and Technical Committee review of Research and Education projects, Extension Training projects and Producer-Initiated projects.
* Issued and negotiated subcontracts for all 1994 SARE/ACE Research and Education projects, Extension Training projects and Producer-Initiated grants.
* Coordinated five site review visits for selected SARE/ACE projects.
* Wrote cooperative agreement between UGA and USDA-CSRS/ES for the administration of the SARE/ACE program.

Outreach and Education Activities

Participated and made presentations about SARE/ACE program at the following meetings:

* Southern Sustainable Agriculture Working Group meeting, January 1994, Austin, TX
* Texas Sustainable Land Management Conference, January 1994, College Station, TX
* National Farm Bureau Federation, January 1994, Orlando, FL
* Extension Committee on Organization and Policy, February 1994, Atlanta, GA
* Fort Valley State College Research and Extension faculty, February 1994, Fort Valley, GA
* Agri-21 TVA meeting, March 1994, Nashville, TN
* Southern Association of Extension Directors, April 1994, Williamsburg, VA
* College of Human Resources, Virginia Tech, May 1994, Blacksburg, VA
* South Carolina State College Research and Extension faculty, May 1994, Orangeburg, SC
* Alcorn State Research and Extension Faculty, May 1994, Lorman, MS
* Tuskegee University Research and Extension faculty, June 1994, Tuskegee, AL
* Southern Rural Development Center Advisory Board Meeting, June 1994, Atlanta, GA
* Joint Experiment Station Director-Extension Directors Meeting, July 1994, San Antonio, TX
* Biannual Meeting of 1890 Research Directors, October 1994, New Orleans, LA

Program Coordination

* Developed Technical Committee and Administrative Council Handbook, January 1994.
* Participated in National Sustainable Agriculture Advisory Committee and Operations Committee Meetings, June and October, 1994.
* Served on steering committee for CAST conference on sustainable agriculture and the 1995 Farm Bill and SANREM Participatory Research Conference.
* Served on Southern Region relevancy review panel, October 1994, Griffin, GA

Communications Accomplishments

Internal

* Designed and produced attractive summary sheets for each active project. These are used in many ways. Together they make up the bulk of the Annual Report and Evaluation Report. They can also be sent out individually or in groups to satisfy requests for information.

* Prepared annual report to Congress

* Participated in decision making for SAN publication activities

* Participated in a meeting at the University of Vermont with the communication specialists from the other regions to decide publications goals and schedule for the next year

* Designed a more efficient and more useful annual report template

* Prepared a call for annual reports which included a letter two months before the due date and a follow-up post card one month before the due date. This greatly improved the ratio of reports arriving on time.

* Prepared this 200-page report for the External Evaluation

External

General Audience

* Produced a flyer promoting SARE/ACE and the upcoming newsletter

* Conducted an audience survey to determine what information readers wanted in a SARE/ACE newsletter

* Conducted a contest for the readership to name the newsletter. Common Ground was the winning name.

* Established an editorial board from SARE/ACE leadership and end users to help focus the newsletter

* Produced three issues of newsletter Common Ground.

* Contributed title "From the Ground Up" and information about projects to Dr. Tina Teague for use in radio broadcasts

* Produced logo and letterhead for Southern Region

* Contributed highlights about pollution control projects to Harry Wells office for use in ACE publications

* Contributed highlights about projects to Citizens Network for Sustainable Development/ United Nations Liaison

* Produced traveling photo display of our regional program that can be customized for any audience. It was used at several meetings around the South by staff and administrative council members.

* Volunteered to coordinate the 1995 National SARE/ACE Highlights with Rodale Press

Farmer Audience

* Produced four-color brochure aimed at farmers

Researcher/Extension Audience

* Produced four-color brochure aimed at researchers

Resource Building

* Mailed letters to all project investigators requesting contact names for their local media as well as color slides and black and white prints for publicity use.

* Had duplicates made of original images sent in by project investigators and used them as a base for an updated slide file in which each slide bears a printed identification label. Catalogued them along with old slides for a file of 400.

* Arranged for bulk mailing permit

* Updated mailing list from 1300 to 3400 names

* Requested addresses of every County Extension office in the Southern Region for the mailing list so we can mail them a disk copy of every active project summary each year

Administrative Council

Mission

The SARE Regional Administrative Councils are responsible to the Secretary of Agriculture through the CSRS-ES partnership. The specific responsibilities are to:

* Appoint a regional host institution and regional coordinator subject to the approval of the cooperative State research Service and Extension Service;

* Make recommendations to the National sustainable Agriculture Advisory council concerning research and education projects that merit funding;

* Promote sustainable agriculture research and education programs at the regional level;

* Establish goals and criteria for the selection of projects within the applicable region;

* Appoint appropriate Technical Committees for evaluation of proposals for projects to be considered for funding

* Review and act upon the recommendations of the Technical Committee and coordinate its activities with the regional host institution;

* Prepare and make available an annual report concerning regional activities in sustainable agriculture (Sec. 1621).

Each Administrative Council shall include representatives from:

* Farmers/ranchers using systems and practices of sustainable agriculture. Appointments should include farmers/ranchers representing Best Utilization of Biological Applications and representing Integrated Management Systems;

* Nonprofit organizations with demonstrable expertise in sustainable agriculture. Appointments should include organizations representing Best Utilization of Biological Applications and organizations representing Integrated Management Systems;

* Agribusiness with demonstrable expertise in sustainable agriculture and one representative from the following:

Agriculture Research Service
Cooperative State Research Service
Environmental Protection Agency
Extension Service
Soil Conservation Service
State Agency Representing Sustainable Agriculture
State Agricultural Experiment Stations
State Cooperative Extension Services
State or US Geological Survey

* Other persons knowledgeable about sustainable agriculture and its impact on the environment and rural communities.

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Technical Committee

Mission

The primary role of the SARE/ACE Technical Committee is to provide guidance concerning the technical merit of proposals and projects to the SARE/ACE program. Technical Committee responsibilities include:

* Evaluate preproposals and full proposals submitted to the SARE/ACE program.

* Participate in project and program reviews.

* Work with the Administrative Council and Host Consortium on developing appropriate proposal and project evaluation guidelines.

Technical Committee membership shall include representatives from:

* Farmers/ranchers using systems and practices of sustainable agriculture. Appointments should include farmers/ranchers representing Best Utilization of Biological Applications and representing Integrated Management Systems;

* Nonprofit organizations with demonstrable expertise in sustainable agriculture. Appointments should include organizations representing Best Utilization of Biological Applications and organizations representing Integrated Management Systems;

* Agribusiness with demonstrable expertise in sustainable agriculture and one representative from the following:

Agriculture Research Service
Cooperative State Research Service
Environmental Protection Agency
Extension Service
Soil Conservation Service
State Agency Representing Sustainable Agriculture
State Agricultural Experiment Stations
State Cooperative Extension Services
State or US Geological Survey

* Other persons knowledgeable about sustainable agriculture and its impact on the environment and rural communities.

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Research and Education Grants

Since the inception of the SARE/ACE program in 1988, over seven million dollars have been distributed to fund research and education activities in sustainable agriculture throughout the South. The goal of the Research and Education Grants, according to Federal guidelines, is to support mission-oriented projects that obtain data, develop conclusions, demonstrate technologies and conduct educational activities that promote sustainable agriculture.

ACTIVE SARE/ACE PROJECTS

Project #	Title	Lead Institution	Project Coordinator	SARE/ACE Funds	Matching Funds	Project Duration
LS91-31	Biological Control and Its Economics in the Southern U.S.	University of Florida	J.H. Frank	$ 49,970	$ 180,869	3 years
LS91-32	Economically Viable Production of Vegetables in the Southern Region Using Low-Input and Sustainable Techniques: A Database	North Carolina State University	M.M. Peet	$ 37,000	$ 39,770	2 years
LS91-33A	Reference Manual of LISA Resource Management Strategy Budgets for the Mid-South Region	TVA (Moved from University of Tennessee)	L.A. Johnson	$ 50,000	$ 50,000	2 years
LS91-34	Total Resource Budgeting of LISA Related Management Strategies	Auburn University	J. Crews	$ 19,500	$ 36,648	1 year
LS91-35	Improved Nitrogen Use-Efficiency in Cover Crop Based Production Systems	North Carolina State University	M. Wagger	$ 179,992	$ 261,922	3 years
LS91-36	Pest Management and Orchard Floor Management Strategies to Reduce Pesticide and Nitrogen Inputs	Oklahoma State University	M. Smith	$ 150,000	$ 74,656	3 years
LS91-37	Low-Input Crop and Livestock Systems for Southeastern United States	Virginia Tech	V. Allen	$ 360,000	$ 95,180	2 years
LS91-38	Developing and Extending Minimum Input Strategies for Weed Control in Agronomic and Horticultural Crops	University of Arkansas	F. Baldwin	$ 100,000	$ 109,571	2 years
LS91-39	Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study (To be continued as AS93-10)	University of Arkansas	D. Miller	$ 200,000	$ 128,992	2 years
LS91-40.1	Utilization of Winter Legume Cover Crops for Pest and Fertility Management in Cotton	University of Arkansas	C. Rothrock	$ 104,000	$ 89,280	1 year
LS92-45	Use of Organic Nitrogen Sources for Sweet Potatoes: Production Potential and Economic Feasibility (To be continued as AS92-6)	North Carolina State University	W. Collins	$ 105,000	$ 44,380	2 years 7 months

Project #	Title	Lead Institution	Project Coordinator	SARE/ACE Funds	Matching Funds	Project Duration
LS92-46	Development of Cropping Systems for Nematode Management on Agronomic and Horticulture Crops	University of Florida	D.W. Dickson	$ 155,000	$ 184,350	3 years
LS92-47	Farm Scale Evaluation of Alternative Cotton Production Systems	Texas A&M	W. Lyle	$ 60,000	$ 112,300	1 year
LS92-48	Developing Environmentally Sound Poultry Litter Management Practices for Sustainable Cropping Systems	Texas A&M	D.R. Earhart	$ 140,000	$ 116,669	3 years
LS92-49	Organic Soil Amendments of Agricultural By-products for Vegetable Production Systems in the Mississippi Delta Region	Arkansas State University	T. Teague	$ 140,000	$ 64,579	3 years
LS92-50	Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education (To be continued as LS92-50.1)	Community Farm Alliance	J. Worstell	$ 37,500	$ 55,500	3 years (1st year funding)
LS92-50.1	Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education (Continuation of LS92-50)	Community Farm Alliance	J. Worstell	$ 90,550	$ 57,313	3 years (2nd year funding)
LS92-50.2	Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education (Continuation of LS92-50.1)	Community Farm Alliance	J. Worstell	$ 98,800	$ 44,687	3 years (3rd year funding)
LSE92-1	Southern Region Sustainable Agriculture Workshop	NC Cooperative Extension Service	R. Crickenberger	$ 9,500	none	3 years
LS93-51	Warm-Season Forage Grasses as Rotations for Sustaining Profitable Peanut Production	Auburn University	R. Rodriguez-Kabana	$ 183,000	$ 48,500	2 years
LS93-52	Utilization of Dairy Manure in Low-Input, Conservation Tillage Animal Feed Production Systems	University of Tennessee	M. Mullen	$ 90,635	$ 36,123	3 years
LS93-53	Sustainable Whole Farm Grain/Silage Production Systems for the Southeast	Auburn University	D.W. Reeves	$ 240,639	$ 218,600	3 years
LS93-54	Evaluation of Low-Input, No-Till, No-Herbicide Continuous Grazing System for Grazing Cows	Clemson University	J.A. Bertrand	$ 118,911	$ 62,700	3 years

Project #	Title	Lead Institution	Project Coordinator	SARE/ACE Funds	Matching Funds	Project Duration
LS93-55	Cover Crop Integration into Conservation Production Systems for Cotton and Sorghum	USDA/ARS	S. Dabney	$ 135,540	$ 117,040	3 years
LS93-56	Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production (To be continued as AS93-9)	University of Georgia	C. Sheppard	$ 2,150	$ 513	1 month
LS94-57	Disease and Insect Management Using New Crop Rotations for Sustainable Production of Row Crops	University of Georgia	B. Cunfer	$ 152,200	$ 52,614	3 years
LS94-58	Post-CRP Land Management and Sustainable Production Alternatives for Highly Erodible Lands in the Southern Great Plains	USDA/ARS	T. Dao	$ 196,100	$ 90,000	3 years
LS94-59	Assessing the Impact of Beneficial Insect Populations on Organic Farms (To be continued as AS94-13)	North Carolina State University	G. Kennedy	$ 17,735	none	2 years
LS94-60	Integration of Animal Waste, Winter Cover Crops, and Biological Antagonists for Sustained Management of Columbia Lance and Other Associated Nematodes on Cotton	North Carolina State University	K.R. Barker	$ 46,721	$ 12,356	1st year of 3
LS94-61	Integrating Sustainable Forestry into Whole Farm Management of Minority and Limited-Resource Landowners in Three Regions of Arkansas	Winrock International	S. Miller	$ 246,710	$ 159,086	3 years
LS94-62	Intercropping Small Grains and Lupin for Sustainable On-Farm Utilization	Auburn University	E. van Santen	$ 143,151	$ 164,759	3 years
LS94-63	Regional Center for Sustainable Dairy Farming	North Carolina State University	S. Washburn	$ 180,497	$ 127,924	3 years
LS94-64	Development of Sustainable Area-Wide Weed Management Practices for Improved Land Utilization (Continuation of AS93-8)	University of Tennessee	J. Grant	$ 3,760	none	6 months
TOTAL SARE PROJECTS				**$3,844,561**	**$2,836,881**	

Project #	Title	Lead Institution	Project Coordinator	SARE/ACE Funds	Matching Funds	Project Duration
AS92-1	An Integrated Technological and Marketing Strategy to Make Broiler Production More Sustainable	Winrock International	F. Busby	$ 200,000	$ 101,409	3 years
AS92-2	Habitat Enhancement for Beneficial Insects in Vegetable and Fruit Farming Systems	Rodale Institute	J. Bachmann	$ 200,000	$ 79,975	3 years
AS92-3	Integration of Natural Enemies for Management of the Sweet Potato Whitefly and Associated Disorders on Mixed-cropped Vegetables	University of Florida	D. Shuster	$ 170,000	$ 77,789	2 years
AS92-4	CROPS, the Crop Rotation Planning System, for Whole-Farm Environmental and Economic Planning	Virginia Tech	N. Stone	$ 140,000	$ 88,247	2 years
AS92-5	Effects of Sustainable and Conventional Agriculture on Farm Wildlife	North Carolina State University	J.R. Anderson	$ 130,000	$ 130,100	3 years
AS92-6	Use of Organic Nitrogen Sources for Sweet Potatoes: Production Potential and Economic Feasibility (Continuation of LS92-45)	North Carolina State University	W. Collins	$ 15,000	$ 6,340	4 1/2 months
AS93-7	Evaluation of Recycled Paper Mulch as an Alternative to Black Plastic Mulch in Vegetable Horticulture	VA Assoc. for Biological Farming	M. Schonbeck	$ 40,000	$ 10,100	2 years
AS93-8	Development of Sustainable Area-Wide Weed Management Practices for Improved Land Utilization (To be continued as LS94-64)	University of Tennessee	J. Grant	$ 165,000	$ 133,000	2 1/2 years
AS93-9	Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production (Continuation of LS93-56)	University of Georgia	C. Sheppard	$ 49,100	$ 12,300	23 months
AS93-10	Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study Based on Agronomic, Environmental, and Economic Factors (Continuation of LS91-39)	University of Arkansas	D.M. Miller	$ 100,000	$ 64,043	1 year
AS93-11	Use of Poultry Litter or Manure for Root-Knot Nematode Management on Vegetables and Field Crops (To be continued as AS93-11.1)	Clemson University	B.A. Fortnum	$ 99,900	$ 82,000	2 years

Project #	Title	Lead Institution	Project Coordinator	SARE/ACE Funds	Matching Funds	Project Duration
AS93-11.1	Use of Poultry Litter or Manure for Root-knot Nematode Management on Vegetables and Field Crops (Continuation of AS93-11)	Clemson University	B.A. Fortnum	$ 46,792	none	1 year
AS94-12	Waste Management Systems for Loafing Areas in Dairies	Clemson University	D. Brune	$ 68,613	$ 26,540	1 year
AS94-13	Assessing the Impact of Beneficial Insect Populations on Organic Farms (Continuation of LS94-59)	North Carolina State University	G. Kennedy	$ 37,207	$ 14,068	2 years
AS94-14	Forage, Biomass and Biogas Integrated Systems for Animal Waste Management	Texas Agricultural Experiment Station	M. Sanderson	$ 101,180	$ 157,894	3 years
AS94-15	Integrated Grazing Systems Planning and Decision Support for Improved Sustainability and Environmental Quality	University of Kentucky	L. Turner	$ 27,500	$ 67,115	1 year
AS94-16	Development of Guidelines for and Demonstration of Efficient Treatment of Swine Lagoon Wastewater by Constructed Wetlands	Auburn University	T.A. McCaskey	$ 130,325	$ 78,553	3 years
AS94-17	Transitioning to Sustainable Methods in Sugarcane Farming	Northside Planting Co.	J.Judice	$ 15,000	none	1 year
TOTAL ACE PROJECTS				**$1,735,617**	**$1,129,473**	
TOTAL SARE/ACE PROJECTS				**$5,580,178**	**$3,966,354**	

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Final Report
Project LS91-31

Biological Control and its Economics in the Southern United States

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F.D. Bennett
Retired , 1993

Background

Many hundreds of species of nematodes, molluscs, insects, mites, plant diseases, and weeds are major or minor pests in the southern United States. But farmers, growers, ranchers, and homeowners don't always have to do something to control them, because "nature" takes care of the problem. Sometimes "nature" is the weather, but at other times it is natural enemies (predators, parasites and diseases of the pests). For example, horn fly can be a major pest of cattle throughout the region, but well over 90% of all horn fly eggs and larvae (which develop in cattle dung) can be destroyed by predators and parasitoids without any action on the part of the rancher. Indeed, action by the rancher can make things worse: pesticides fed to cattle in attempt to kill biting flies can destroy the predators and parasitoids in the cattle dung, resulting in more adult horn flies than before, because horn fly is now resistant to virtually all chemical pesticides, but the natural enemies are still susceptible.

Simply stopping use of chemical pesticides usually is not a viable solution to pest problems. Some chemicals remain effective, at least at present. Many natural enemies will not do an adequate job of controlling pests without help, if at all. First and foremost, farmers, growers, ranchers and homeowners, must acquire considerable depth of knowledge about pests, what it takes to control them under their conditions, and the comparative costs and benefits of the strategies available.

Objectives

To use partial budgeting to analyze the economics of classical biological control researched and developed in the Southern Region. To expand an existing computerized database on biocontrol so that all available information from or relevant to the Southern Region is entered, including the results of the economic analyses (above). To make this information available to potential users throughout the Southern Region by the SARE information network (internet/telnet), and keep it updated.

Approach

Methods fall into five areas: (1) Bibliographical searches and assembly for biological information on all major (and many minor) agricultural pests in the Southern Region with their native natural enemies and all biological control agents that have been imported against them. (2) Bibliographical searches for existing economic analyses of use of biological control in the Southern Region and nearby states. (3) Support of new studies, as projects for graduate students, on economics of use of biological control. (4) Programming the structure of the database, for filing and retrieving information, and for distribution of the information by internet/telnet. (5) Data entry.

Results

Results fell short of expectations in two areas because of under-funding of the project. The initial request was for funds to support a post-doctoral research associate, with training in entomology and economics, who would work full-time on the project. Funds offered allowed support only of one untrained graduate student. Most of the funds awarded were used for the stipend of this graduate student who obtained training by taking courses toward an M.S. degree in economics. Two of the activities of the graduate student contributed to the database: (a) a research project in economics of biological control of two pest species, and (b) a bibliography on economics of biological control. The database was to be constructed and installed on two IBM-clone personal computers with IBM-DOS operating system and gateway to the internet. The computers and software and gateway functioned, but the database could not be made interactive with users at remote locations without additional telnet daemon software, i.e., such users could read short messages, but could not make the database function. Telnet daemon software was available for Unix operating systems, but was only just becoming available in 1993 for the much less expensive IBM operating systems. We had no funds to purchase Unix operating systems in place of IBM operating systems for our computers. Our part-time computer programmer investigated telnet daemon (for IBM) commercial software and, after much time and effort and interaction with the manufacturers, found none of it satisfactory.

Project area
Biological control
Project duration
July 1991- November 1994

Budget:
SARE/ACE $49,970
Matching $180,869

This time and effort reduced the amount of time the programmer had available for programming the structure of the database which, consequently, is still incomplete. The telnet daemon software we now have will *almost* function, but needs further refinement by its manufacturers, which is likely to happen soon.

We now have a partially completed database which will generate more than 1,000 pages of basic information on crops, pests, and biological control agents of the pests. Yet this is a fraction of the information required to be entered into the database to make it useful to farmers (it already is useful to researchers). We have assembled much of the available additional information, but have not yet entered it. Economic studies of biological control methods for many pests have not been made. We feel that our database is the best way of providing information, but it needs additional financial support to speed development.

SARE/ACE
Sustainable Agriculture Research and Education
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Final report
LS91-32

Producing Vegetables in the South Using Low-input Sustainable Techniques: Collection and Analysis of a Database

Project Coordinator

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Objectives

1.) Determine the best content and format to make a manual on reduced-input vegetable production useful to farmers and extension workers as well as researchers, teachers, and students. Identify particular farmers as resources and/or reviewers for the manual.

2.) Compile database of information on commercial production of vegetables in the Southeastern U.S. using reduced input and organic techniques such as organic fertilizers, cover crops, rotations, cultivar resistances and IPM protocols.

3.) Evaluate the material compiled for usefulness and reliability and organize into a production Manual for the major vegetable crops grown in the southeastern U.S.

4.) Disseminate database in hardcopy form through the publication of an annotated bibliography and through a vegetable production manual.

Approach

During the first year of the grant (1991), after interviewing potential users and people who worked with potential users, we decided to concentrate on providing a low-cost printed version of the material. This decision was made based on our observation that there seemed to be many obstacles to electronic delivery at the farm level and even at the level of county extension offices when considering the entire southeastern U.S. As a result of these interviews, we also found that growers and extension agents had difficulty with weed control and found it difficult to obtain information on cover crops, living mulches and solarization.

We began collecting information in 1991. In fall 1992 we began circulating draft copies of chapters for technical review. Revised chapters have been circulated to some of the original reviewers and also selected new reviewers. The bulk of the information to be included was in final form by the time of the last annual report (December 1993). Last January and February we obtained final reviews on all the chapters and in March sent the entire 330 page document to 4 reviewers, an organic vegetable farmer, a researcher at Rodale, two extension specialists and an educational media specialist at NCSU. Their comments were received by the beginning of June, and appropriate revisions have been made.

Results

AgAccess has agreed to publish and distribute the completed manuscript, assuming approval by reviewers they select. They estimate publication within a year and an approximate cover price of $20.00

In its current version this document is 330 pages long, double spaced. The first half consists of material applying to all crops. The soil management chapter describes ways to improve the physical characteristics and biological activity of the soil and how to substitute manures and composts for high-analysis fertilizers. The reader is referred to tables showing the average nutrient content of manures and other potential fertilizer or compost materials, including cover crops. The reader is, however, cautioned both in the crop chapters and on the tables of the necessity for testing the soil to determine the need for additional minerals and to also have the amendments tested to determine their actual content, rather than relying on the information in the table. The nutrient content of selected conventional fertilizers and liming materials is also given, along with the leaching risk and volatilization potential for N sources.

The cover crops chapter provides general guidelines for using cover crops and living mulches and discusses the advantages and disadvantages. It then lists 22 cover crops that can be grown in the southeastern U.S. along with their seeding rates, climatic and soil requirements and other useful information such as whether they are annual or perennial, whether they fix nitrogen and whether reseeding is a problem. IPM practices for insects, diseases and weeds are described in the next three chapters.

The insect and disease IPM chapters cover general principles and practices such as crop rotation and the use of beneficials, botanical

Project area
Vegetable production

Project duration
February 1991-March 94

Budget:

SARE/ACE	$37,000
Matching	$48,341

and biocontrols. They then briefly describe the life cycle of some of the common insects and diseases of vegetables in the southeastern U.S. Nematode control is discussed in the disease chapter. Economic threshold, biocontrol or other useful information is also given, if available.

The weed IPM chapter presents information on prevention, critical weed-free periods and solarization, among other topics, but does not discuss specific weeds except as examples. In appendices, the reader is referred to additional resources for pest identification and for further discussion of many topics.

The second half of the document consists of crop profiles for 12 vegetable crops grown in the southeastern U.S. These are: beans (including limas, snapbeans and southern pea); cole crops; sweet corn; eggplant; watermelon; okra; peppers; pumpkins; squash; sweetpotato; potato and tomato.

For a crop to be included, at least 10% of the national production or 6% of the national production acreage had to be located in the Southern Region. In addition, to be included, the crop had to be grown on significant acreage in more than one state in the Southern Region.

If specific information was found on the use of cover crops or organic mulches or other sustainable practices on this crop in the Southeast, it is also included in the crop chapter. To help farmers make decisions on economic and marketing factors, each crop chapter contains information on where the crop is produced and trends in per capita consumption.

Since implementing sustainable practices successfully requires familiarity with the biology of the crop as well as the pest and knowledge of standard cultural practices, these background chapters also provide the reader with information on the soil, climate and irrigation and cultural requirements for each crop. Harvest and postharvest considerations are also described briefly.

If insect pollinators, trellising or other specific cultural practices are required, these are also described, along with the implications for growers using sustainable practices. For the major diseases, resistances, if any, are listed for current and some older cultivars. Where insect tolerances have been documented, these are also listed in the crop chapter.

An index and list of the almost 250 references cited have been compiled for the entire document and appendices prepared. The appendices consist of: maps of the soil and climate zones in the southeastern U.S.; a description of how to calculate heat units; an example of the economics of organic tomato production; a description of the organic certification process and the status of certification in the states of the Southern Region; a list of additional publications, the addresses of all publication distribution offices for the Cooperative Extension Services for the states of the Southern Region and a list of organizations active in sustainable agriculture in the Region.

SARE/ACE
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Final Report
LS91-33A

Reference Manual of LISA Resource Management Strategy: Crop Budgets for the Mid-South Region

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Objectives

Conventional agriculture requires specialized, capital intensive systems that are dependent upon high levels of purchased inputs. Excessive use of many of these inputs can have detrimental effects upon the environment, raise food safety issues and often result in lower returns to farmers and increased risk levels. Environmental and food safety improvements can be made, and farmers would gain financially from reduced cost levels associated with the incorporation of proven low-input farming methods.

The objective of this proposal was to develop Resource Management Strategy (RMS) crop budgets for selected crop enterprises and cropping systems located in the mid-south region. The budgets provide sound economic information on sustainable management practices to farmers, Extension personnel, ASCS and SCS offices and other interested individuals and organizations.

Approach

Standard budgetary analysis procedures were used to develop multiple crop RMS budgets for selected rotation schemes. Representative cropping strategies applicable to farmers in the mid-south region were identified and cropping alternatives analyzed.

Economic and environmental data were collected from various sources including farm records, experiment station data, and consultations with Extension specialists, County Extension Agents, SCS and EPA officials. Representative price and yield data were based on information provided by the Agricultural Statistical Reporting Services of representative states. Input costs, such as chemicals, fertilizer and interest were collected from a sampling of input suppliers and agricultural lending institutions. Budget format conforms to the SMART-FRMS system at the Center for Sustainable Agriculture.

Each RMS crop budget included a complementary set of decision aids to assist farmers in assessing the economic and environmental impacts of each decision. The decision aids included were break-even tables, costs and returns over relevant ranges of prices and yields, and various environmental impacts. Costs and returns were identified for various resource levels so farmers can easily adjust to reflect their own situation.

An advisory and review committee was organized. The committee was comprised of Extension Specialists, farmers, and TVA participants. The committee assisted in developing the work plan, identifying applicable resource management strategies and giving advice regarding practical applications for the different strategies. The final phase of committee assignments included a review and approval of the final document listing budgets for the selected *Resource Management Strategy Crop Budget Manual.*

Results

The study resulted in the development of detailed cost, return, break-even and other budgetary data for 300 enterprise, rotation, and system budgets. These include traditional crop, livestock, fruit, vegetable, and specialty crops; alternative tillage system budgets for major field and forage crops including conventional, no-tillage, conservation tillage, contour and various contour strips; as well as low-input livestock operations, rotational systems, and organic crop budgets.

Project area
Economic analysis

Project duration
July 1991-June 1994

Budget:

SARE/ACE	$50,000
Matching	$50,000

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Sustainable Agriculture Research and Education
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Final report
Project LS91-34

Total Resource Budgeting of LISA Related Management Strategies

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Project area

Whole farm economics

Project duration

February 1991-January 1994

Budget:

SARE/ACE	$19,500
Matching	$36,648

Objectives

The objective of this project is to help farmers make logical, economic choices among conventional and low-input enterprises and technologies in developing more effective farm financial management strategies. Specific project objectives are to:

1.) Develop enterprise budget information, including costs, returns and total resource use, that will support state and regional Extension-research projects designed to develop and disseminate information pertaining to low-input, sustainable agriculture (LISA).

2.) Contribute to the program development and support of SMART-FRMS national project to provide farmers with a practical, usable decision support system needed to evaluate potential impacts of alternative enterprises and technologies on expected revenues, whole-farm risks and sustainability of their farming operations.

Approach

Approximately 40 rotational enterprise systems deemed sustainable and environmentally compatible were developed using the LISA-FDSS (SMART) software program. Whole farm analyses indicated significant variations in aggregate returns and/or risk exposure. Those systems combining crop mixes with livestock enterprises (substituting waste for commercial fertilizer and/or feedstuffs) showed promise in terms of long-term profitability while maintaining environmental integrity.

The results should provide producers with an assessment of the interaction of both economic and biological factors. Producers will be able to evaluate farm/field level alternatives given their own set of resources and criteria in terms of production, financial and environmental limitations. The magnitude of risk and trade-offs will enhance each decision maker's ability to transition into management strategies which are economically and environmentally sound.

An interdisciplinary team of Extension specialists were assembled to provide input in the development of approximately 40 rotational and/or crop/livestock systems based on their feasibility and adoptability for Alabama and southern agriculture.

Results

Preliminary findings indicate a large degree of potential risk (production, environmental, financial) inherent to those systems evaluated. Due to current limitations in the SMART system software, final analyses and field testing with producers have not been completed.

Beginning with the final field-testing stages of the project, Extension personnel and selected producers will be trained using computer software and underlying methodologies. Extension personnel have already received training on sustainable agricultural system approaches and methodologies plus exposure to the SMART system software. Forthcoming Extension publications describing the study (and potential impact) will accompany area workshops. Computer software support and documentation will also be made available to Extension personnel to enhance producer adoption and analyses.

The work has been coordinated with John Ikerd's LISA-FDSS Program and the Center for Farm Financial Management at Minnesota via the SMART system software. Over 40 systems (databanks) have been completed and shared with Minnesota. Final whole-farm analyses will be completed using the newer version of the SMART software.

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Final Report
LS91-35

Improved Nitrogen Use-Efficiency in Cover Crop Based Production Systems

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Objectives

1.) Evaluate the potential of several cover crops to capture residual fertilizer N from a corn production system.

2.) Study the field and laboratory decomposition of cover crops for the purpose of developing a simulation model to describe N release from cover crops over a wide range of soil and climatic environments.

Approach

Field experiments were conducted over a two-year period in three physiographic regions (Coastal Plain, Piedmont, and Mountains) of the southeastern USA. Four cover crops (rye, wheat, spring oat, and crimson clover), along with a fallow or no cover treatment, were evaluated for their ability to recover soil N following corn harvest. Cover crop measurements included patterns of dry matter and N accumulation from early winter until row crop planting in the spring. Soil sampling for inorganic N determinations coincided with the schedule for cover crop sampling. Cover crop growth was terminated in April/May and corn planted via no-tillage. Corn yield was measured in each of the cover crop based production systems.

Cover crop decomposition was monitored with nylon mesh bags containing plant residue from the respective cover crop treatments. Mesh bags were placed on the surface of corresponding cover crop plots one week after corn planting and retrieved at various intervals during the growing season. The dry weight and residue N remaining in each bag was then used to develop N release curves over time for each cover crop residue. As a corollary to the field decomposition studies, laboratory experiments were conducted to describe cover crop N release under varying moisture and temperature environments.

Results

In general, dry matter and N accumulation by crimson clover lagged behind the small grain cover crops (rye, wheat, and oat) from late fall to early spring at all locations. Relative growth rates among the grass cover crops during this same period were in the order rye > wheat > oat on the Piedmont soil and rye > oat > wheat on the Coastal Plain soil. Wheat accumulated the greatest amount of biomass at the Mountain location. The N content in above-ground cover crop biomass, across all locations, ranged from 22 to 156 lb N/A. Crimson clover typically had the highest N content in above-ground biomass by corn planting. In contrast, soil inorganic N concentrations prior to corn planting were generally lower under grass compared to legume cover crops, suggesting that grasses were more efficient scavengers for residual N in soil.

Field decomposition of cover crop residues indicated that crimson clover released N faster to the subsequent corn crop than the grass cover crops. This faster N release by crimson clover was more evident during the early part of the growing season (4 to 6 weeks).

Laboratory decomposition studies were conducted to assess the dynamics of C and N mineralization from leaves and stems of crimson clover, rye, oat, and wheat. In general, CO_2 emission rates were highest for leaves and lowest for stems. The total CO_2-C evolved and remaining C after 160 days for leaves and stems of all residues was similar to the amounts predicted from isolated leaves and stems. In contrast, net N mineralized from leaves and stems of oat and wheat was higher than the amount predicted from isolated plant parts. Data from these and other studies will be used to adjust a simulation model of N mineralization. Results from this research illustrate the role winter annual cover crops can play in conserving N within the soil-plant-system while maintaining soil productivity. A relatively simple model describing N release from cover crop residues will enable further streamlining of summer crop N requirements. Finally, this work suggests that a grass legume/ biculture may incorporate the nutrient scavenging abilities of grasses and the N contribution of legume, thereby fostering more efficient nutrient management in cropping systems.

Project area

Cover crops

Project duration

February 1991-March 1994

Budget:

SARE/ACE	$175,513
Matching	$244,036

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Sustainable Agriculture Research and Education
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Final Report
LS91-36

Pest Management and Orchard Floor Management Strategies to Reduce Pesticide and Nitrogen Inputs

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Project area
Pest management

Project duration
Feb. 1991 - Sept. 1994

Budget:
SARE/ACE $150 ,000
Matching $113, 656

Objectives

The purpose of this study is to develop and test a pest management and orchard floor management system for use by pecan growers. The system utilizes winter legumes interplanted in the orchard to produce and manage native beneficial insect predators and parasites for early-season aphid control. The system also utilizes release of commercially available predators and parasites for mid- and late-season aphid control and control of lepidopterous pests. Legumes are managed to supply the pecan nitrogen requirement.

Approach

Annual legume ground covers were evaluated in pecan (*Carya illinoinensis* [Wangenheim] K. Koch) to supply nitrogen and increase beneficial arthropods. Releases of *Chrysopa rufilabris* (Burmeister) (Neuroptera: Chrysopidae) were evaluated as a biological control for late-season pecan aphids.

Treatments were 5 ha of a 'Dixie' crimson clover (*Trifolium incarnatum* L.) and hairy vetch (*Vicia villosa* Roth) mixture and 5 ha of grass sod. Nitrogen was applied at 0-168 kg·ha^{-1} in 56 kg increments to grass plots but no nitrogen was applied to the legume plots.

The most abundant beneficial arthropods sampled in the legumes were spiders, lady beetles, green lacewings and nabids, respectively. Legume ground covers did not increase the densities of beneficial species in the pecan canopies. The most abundant beneficial arthropods in the pecan canopies were spiders, green lacewings, brown lacewings and lady beetles, respectively. Predominant lady beetle species in the legumes were *Hippodamia convergens* (Guerin-Meneville), *Coleomegilla maculata lengi* (Mulsant) and *Coccinella septempunctata* (L.) (Coleoptera: Coccinellidae) while the most abundant species in the pecan canopies were *Olla v-nigrum* (Mulsant), *Cycloneda munda* (Say) and *Hippodamia convergens*.

Releases of *Chrysopa rufilabris* were not effective as a biological control of pecan aphids. Release of *Trichogramma* sp. to control pecan nut casebearer (*Acrobasis nuxvorella)* and hickory shuckworm (*Acrobasis nuxvorella)* was ineffective. The legume mixture supplied over 100 kg·ha^{-1} N to the pecan trees. Legumes significantly increased soil nitrate concentration during the fall compared to soil from grass plots.

Results

Beneficial arthropods were more abundant in orchards with legume ground covers compared to those orchards with grass ground covers. These beneficials were attracted into the orchards because of the large aphid populations feeding on the legumes. However, beneficials in the pecan canopies were similar using either a legume or non-legume ground cover. Aphids feeding in the pecan canopies were usually lower using a legume ground cover.

Release of green lacewings for mid- and late-season aphid control was detrimental to lacewing populations. Although green lacewing egg laying and pupae were increased by supplemental releases, parasitism of the green lacewing eggs and pupae was increased, thus populations of green lacewings were similar or lower than in orchards without supplemental releases. However, in both cases aphids did not increase to injurious levels.

Trichogramma releases to control pecan nut casebearer and hickory shuckworm were not successful. Although populations of these two lepidopterous pests were reduced, their damage was above acceptable levels.

Legume ground covers produced abundant nitrogen which satisfied the nitrogen requirement of the pecans. Our results indicated that legumes supplied the equivalent of 130 to 165 pounds of nitrogen/acre to the pecan trees. An additional benefit of annual legume ground covers was a reduction in the number of times the orchard required mowing. Because the legumes formed a dense mulch when they senesced, orchards were only mowed twice compared to five to six times with grass ground covers. Legume ground cover may eliminate one to two pesticide applications, plus reduce mowing costs and supply the nitrogen requirement; however, costs

would be added for seed bed preparation and seed, with a net reduction in input costs of about $20 to $40/acre.

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Annual Report
LS91-37

Low Input Crop and Livestock Systems for the Southeastern United States

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Project area
Whole farm systems

Project duration
January 1992-April 1995

Budget:

SARE/ACE	$360,000
Matching	$425,000

Objectives

This interdisciplinary project is a multifaceted research and education program funded by the USDA LISA Program from 1988-1990 and the SARE/ACE Program from 1991-1994.

It consists of three major components: (1) a long-term Whole Farm Systems Research Project involving crops and livestock, (2) an on-farm systems demonstration, and (3) the development and implementation of a low-input corn production system. The overall objectives are to develop and evaluate crop/livestock farming systems that minimize reliance on nonrenewable inputs while maintaining crop and animal productivity, maintaining economic viability, improving long-term soil productivity, and minimizing environmental impact.

Whole Farm System

Objectives

The first component, the Whole Farm Systems Research Project, is an interdisciplinary research and education Farming Systems Project, begun in 1989, and located at the VPI&SU Kentland Research Farm, Blacksburg, Virginia, USA. It is a replicated farm-scale experiment designed to compare a conventional crop/livestock system with an experimental, alternative, sustainable system to produce cattle of desirable slaughter weight and grade.

Approach

Each system involves 48 steers per year and 32 hectares (80 acres) of crop and pasture land. The Conventional System uses technology currently recommended by state extension specialists and practices currently in use by producers in Virginia. The Sustainable System uses grazing management for pest control and nutrient management as well as improved animal performance. Crop production includes rotations, use of legumes, development and demonstration of reduced chemical input corn production practices, use of conservation tillage systems, winter annual cover crops, and integrated pest management practices for weed and insect pest.

Results

Results to date have demonstrated that nitrogen inputs can be reduced by one half or more with no reduction in crop or livestock production. The Sustainable System has dramatically reduced requirements for pesticides while maintaining crop productivity and weed control. Effects of grazing system on internal parasites in steers is being investigated.

Animal production was slightly higher for the Conventional System during the first two cattle cycles but this has reversed and steers on the Sustainable System have had higher gains during the third and fourth cattle cycles. Beef produced in the Sustainable System required 32% less energy/kilogram than beef produced in the Conventional System. Less energy has been required per unit of corn silage produced on the Sustainable System.

Crop rotation on the Sustainable System has successfully controlled Western Corn Rootworm at a savings of about $15/acre since a soil insecticide has not been necessary. Profitability of the two systems has been similar thus far but a longer time period will be necessary to access risks.

Grazing System

Objectives

The second component of this project is a complementary on-farm grazing systems demonstration project which has been established on a cooperator farm in Southwestern Virginia.

Approach

Intensive grazing management, the use of legumes vs. nitrogen fertilizer, and the sequencing of various forage species for year-round grazing are being implemented. Systems are being designed to demonstrate profitable beef production on steep hill lands in systems that promote nutrient recycling with reduction of external chemical inputs, avoid runoff and erosion, and maintain stable stream banks and clean water. This project, located on the River Ridge Farm in Grayson County, VA, is now in place with significant matching financial support from the cooperating farmer. Effects of grazing management on stream bank erosion and water quality are being investigated at this location.

Corn Production System

Objectives

The third component of this project involves the development and demonstration of sustainable corn production practices, including the use of conservation tillage systems, winter annual legume cover crops, and integrated pest management practices for weeds and insect pests. Test-demonstrations are conducted on farms throughout Virginia.

Results

Research results from the Whole Farm Systems Project as well as component research conducted as a part of this effort has demonstrated that corn can be produced using only a single application of Glyphosate pre-plant while maintaining yields equal to or better than those achieved by conventional no-till corn production techniques. Strategic grazing of the cover crop prior to corn planting may offer additional benefits in weed control and increased corn plant populations.

Educational programs for growers, extension agents and others are coordinated through the Virginia Tech/Virginia State Cooperative Extension Service, and consist of several approaches: (1) multi-county field days, (2) the Annual Virginia Conference on Sustainable Agriculture, (3) Winter grower meetings, (4) Extension agent training tours and workshops in sustainable farming practices and systems, (5) Tours of the ongoing research and test-demonstration projects. Fourteen graduate students have worked on thesis and dissertation research projects that are subcomponents of this overall project.

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Southern Region

Final Report
LS 91-38

Developing and Extending Minimum Input Strategies for Weed Control in Agronomic and Horticultural Crops

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Objectives

1.) Reduce soybean herbicide inputs to less than $10/A by spraying reduced rates on very narrow bands.

2.) Integrate new cultivation technology, especially the Buffalo Ridge till cultivator and Bezzirides in-the-row cultivator, with 1 above.

3.) Integrate ridge-till and crimson clover and rye cover crops, with 1 and 2 above.

4.) Determine which of the cover crops commonly used in this region are most effective for weed suppression; evaluate herbicides commonly used for cover crop destruction before planting; and compare yield obtained by no-till planting of southern peas in these cover crops versus conventional seedbed preparation and management practices.

Approach

Herbicide rates as low as one-fourth those recommended by the manufacturer were equally as effective as labeled rates on weed species, including cocklebur, annual morninglories, pigweeds, annual grasses, and hemp seshania in soybeans. Rates equivalent to one-half the labeled rate provided equal control of johnsongrass.

Herbicide inputs were even further reduced by taking the one-fourth to one-half labeled rates and reducing them two to three more times and applying them on a band. A Buffalo cultivator and precision guidance system was used to accomplish this. Soybean yields were statistically equivalent in treatments with herbicide costs under $7/A compared to the $27/A standard program.

Reduced rate herbicide programs were integrated with allelopathic cover crops, narrow rows and ridge tillage in five experiments in 1993.

Results: Objectives 1 and 2

To demonstrate progress in Objectives 1 and 2, results from one study are submitted. The data are presented in Appendix 1 in the complete text on file in the SARE/ACE office. In this experiment, reduced rate programs were compared with either labeled rate programs (Trt. 9) or grower standards that included reduced rates (Trt. 4). In addition, broadcast treatments of reduced rates were compared to those using similar treatments, but with rates further reduced and applied on a band. Cultivation was with a Buffalo cultivator using a precision guidance system. Even under extreme weed pressure, treatment 8 for example, with $6.52 in herbicide inputs, provided weed control and crop yields equivalent to or better than the standard treatments.

Results: Objectives 2 and 3

To demonstrate progress in Objectives 2 and 3, data from two soybean studies are presented in Appendix 2 and 3 in the complete text on file at the SARE/ACE office. The first study presented (Appendix 2) represents the third year of a cover crop, row spacing, herbicide input study. Rye was used as the cover crop and soybeans were planted in either 30" rows or 7.5" drills. Reduced rate and labeled rate herbicide programs were used in each. While rye has shown excellent allelopathic activity on certain weed species and excellent soybean yields have been produced, the presence of the cover crop has allowed for very little reduction in post-plant herbicide usage and has resulted in increased expenses due to the cost of establishment and the herbicide required to kill it.

This work has been expanded, through the SARE program, to ridge tillage as a means to grow the cover crop at a reduced expense. In two studies, flat planting with and without cover crops (F NOC Contill and F COV NOTILL) were compared to bed or ridge culture with and without cover crops. In the flat, cover, no-till plots, the soybeans were seeded directly into the standing rye with a drill. All others were planted in 30" rows.

The first year was primarily a learning year with the new equipment. Soybean yields were equivalent in the flat planted no-till, rye cover plots (Trts. 5 & 6) compared to conventional treatments (2 and 3). However, the herbicide costs were essentially double in the rye plots. In treatment 8 where the cover crop on the bed was removed with tillage and herbicides were

Project area

Weed control

Project duration

February 1991-January 1994

Budget:

SARE/ACE	$100,000
Matching	$136,011

banded, herbicide costs were similar to those in treatments 2 and 3, but the yields were down. It is felt this can be corrected and provides very promising future direction. Practices that are ready to go to the grower will be much slower to develop in the cover crop tillage system studies then in the conventional herbicide studies. However, excellent long-term results are anticipated.

Results: Objective 4

To demonstrate progress in Objective 4, we evaluated perennial ryegrass, annual ryegrass, grain rye, wheat, oats, crimson clover, red clover and hairy vetch for weed suppression potential and ranked them as follows, red clover > ryegrass > oats > wheat > grain rye > hairy vetch > crimson clover, from most to least effective.

The ranking of the nonselective, burndown herbicide treatments from most to least effective, with rates given in lb ai/a, was: glufosinate 0.75 > paraquat 0.56 > glyphosate 0.75 > glyphosate 1.5. Tank mixing photosynthetic inhibitor herbicides such as atrazine, cyanazine, metribuzin and fluometuron with paraquat did not significantly improve cover crop suppression.

None of the selective grass herbicides (fluazifop-P, sethoxydim, clethodim) evaluated provided acceptable suppression of the grass cover crops.

Southern peas did not emerge aggressively after no-till planting resulting in a poor stand in all treatments. This, combined with an exceptionally hot, dry growing season in 1993, eliminated the possibility of collecting any meaningful yield data. On the other hand it suggests that southern peas are probably not a likely candidate for no-till establishment in cover crops.

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LS91-39A
AS93-10

Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study Based on Agronomic, Environmental and Economic Factors

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Objectives

The goal of the project is to determine under what conditions producers of row crops in the Southern Region can profitably use poultry litter (PL) as a soil amendment. In order to accomplish this, we will:

1.) Quantify both the short-term and long-term agronomic value of poultry litter.

2.) Document the environmental consequences of land application of poultry litter in the row crop regions.

3.) Using the agronomic data on yield responses, estimate the farm level derived demand for poultry litter and poultry litter compost as a soil amendment; integrate the derived demands with costs of acquisition, transportation and application to determine the market feasibility of litter transport from areas of concentrated poultry production.

Poultry production in the U.S. is concentrated in the Southern Region. Disposal of poultry wastes via application to adjacent pasturelands has resulted in excessive fertilization of these soils which in turn has caused a deterioration of surface water quality in the poultry producing areas. Many of the intensively row-cropped soils of the Southern Region would benefit from applications of an organic material such as poultry waste, but these soils are typically far way from the poultry producing areas and the cost of transporting the waste is relatively high. Therefore, the goal of this study was to determine if broiler litter, a mixture of broiler feces and a bedding material such as wood chips, could be transported to and used by row crop farmers in Arkansas and Alabama in an environmentally benign and economically viable manner.

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Project area
Waste utilization

Project duration
July 1993-December 1995

Budget:

SARE/ACE	$300,000
Matching	$200,000

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Sustainable Agriculture Research and Education
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Southern Region

Annual report
LS92-45

Organic Nitrogen Sources for Sweetpotatoes: Production Potential and Economic Feasibility

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Project area
Cover crops

Project duration
Feb. 1991 - January 1994

Budget:

SARE	$105, 000
ACE	$15, 000
Matching	$50, 720

Objectives

This is a 3-year project designed to precisely test a proposed alternative cropping system for sweetpotatoes using crimson clover as an organic source of nitrogen in substitution of inorganic sources. Studies in two states (NC and AL) on experimental stations, small farms (cooperatives of small, resource limited farmers in NC and AL), and larger farms are designed to provide data to support the use of crimson clover as a N source by demonstrating the effect of crimson clover on subsequent yield and quality of the sweetpotato crop itself as well as the effect of using crimson clover in a two-year rotation cycle with sweetpotatoes and corn (a normal practice in the Southeast). In addition, genotypes of sweetpotato particularly suited to this cropping strategy, as measured by their nitrogen use efficiency under the alternative and control strategies, are identified. An economic analysis of the alternative systems as compared to the normal cropping system will be completed. Growers are involved by having experiments grown on small and large-scale farms and by having them estimate the costs and revenues for the economic analysis.

Objectives

The stated objectives of this study are to:

1.) Evaluate yield, quality, and nitrogen cycling in sweetpotatoes using crimson clover as an organic source of nitrogen in different soil types in the Southeast.

2.) Evaluate the effect of crimson clover as an organic N source on nitrogen use efficiency (NUE) of different sweetpotato genotypes (including the effect of time of N availability relative to vine growth, storage root initiation and storage root bulking of individual genotypes) to determine potential for selecting for NUE.

3.) Evaluate the effect of crimson clover as an organic N source on sweetpotato and corn yield and quality (including observational data on disease, insect and weed problems) in a two-year rotation cycle when replacing all or part of the N applied from inorganic sources in the two-year cycle.

4.) Determine the economic feasibility of using crimson clover as an organic source of nitrogen for sweetpotato alone and in a two-year rotation cycle with corn.

Approach

We began this study with a field evaluation of the effect of inorganic nitrogen levels on sweetpotato yield in order to determine the linearity/non-linearity of response to nitrogen so that we would know what range of nitrogen levels to work with. By using several different varieties of sweetpotato, we also determined which ones might have different responses to different levels of nitrogen and therefore might utilize nitrogen more efficiently. This was followed by two years' of field studies using five different nitrogen treatments (full inorganic nitrogen as determined by state recommendations, one-half the full rate, zero nitrogen, an estimated full-rate of nitrogen delivered by incorporating a cover crop of crimson clover into the soil, and a half-rate of nitrogen delivered through crimson clover). In two fields, we superimposed on these treatments a two-year rotation of corn and sweetpotatoes. By combining data from the two year rotation with the five nitrogen treatments we should be able to determine if crimson clover can be used to supply all or part of the nitrogen requirements of sweetpotato and/or corn over two years in the field.

Yield of sweetpotato roots and grain corn (both fresh yield and dry matter yield) were determined for all tests. In addition we measured the nitrogen content of all plant parts at harvest and the nitrogen in the soil before planting, after incorporating the crimson clover, and at harvest. In 1994 data were taken for all plots for weed growth and diseases apparent on sweetpotato.

Results

Results are only analyzed up through 1993 and these are preliminary since final results depend on data from the full two-year study. However, these preliminary results do indicate that yields of sweetpotato roots produced with crimson clover as the source of nitrogen are equal to those produced with inorganic nitrogen as recommended to growers. The roots from crimson clover treatments are lower

in percent nitrogen, percent protein and percent non-protein nitrogen than those from inorganic nitrogen plots.

This may indicate that sweetpotato roots from crimson clover treated plots used nitrogen more efficiently (i.e. they did not store it) while attaining the same yields as with inorganic nitrogen. In addition, there are clearly differences in the ability of sweetpotato varieties to take up and utilize nitrogen efficiently.

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Southern Region

Annual Report
LS92-46

Development of Cropping Systems for Nematode Management on Agronomic and Horticultural Crops

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Objectives

Our goal is to demonstrate the effectiveness and economic benefits of selected cropping systems for low-input, sustainable management of root-knot nematodes.

Specific objectives are to:

1.) Develop and demonstrate the usefulness of selected tropical crops (short term) and forage crops (long term) in suppressing population densities of root-knot nematodes below damage levels;

2.) Provide information on crop yields, production costs, pesticide use, net returns, and financial risks due to adoption of these alternative crops;

3.) Determine the biomass added to the soil by each crop and the nitrogen mineralization following each crop; and

4.) Demonstrate and test models of seasonal nematode multiplication on the alternative crops.

Approach and results

Field experiments were conducted in north Florida (Suwannee County) from 1991-93 and in Alachua County in 1993-94. The crop sequences at the Suwannee County site were: (i) rotation crops during summer 1991; (ii) cover crop of rye during winter 1991-92; (iii) 'Lemondrop L' squash during spring 1992; (iv) rotation crops during summer 1992; (v) rye during winter 1992-93; (vi) 'Classic' eggplant during spring 1993.

The eight summer crop rotation treatments were: 'Hale' castor, velvetbean, sesame, American jointvetch, weed fallow, 'SX-17' sorghum-sudangrass, 'Kirby' soybean, and 'Clemson Spineless' okra as a control. Rotations with castor, velvetbean, American jointvetch, and sorghum-sudangrass were most effective in maintaining the lowest population densities of two root-knot nematode species (a mixture of the Southern root-knot nematode and the peanut root-knot nematode), but stubby root nematode built up in the sorghum-sudangrass rotation.

Yield of squash was significantly lower following sorghum-sudangrass than after any of the other treatments except fallow. Yield of eggplant was significantly greater following castor, sesame, or American jointvetch than following okra or fallow. Several rotation crops evaluated here may be useful for managing nematodes in the field and for improving yields of subsequent vegetable crops.

In Alachua County in the 1993-94 seasons, rotation crops of castor, velvetbean, 'Mississippi Silver' cowpea, 'Deltapine 51' cotton, and 'SX-17' sorghum-sudangrass were effective in maintaining low densities of the Southern root-knot nematode, whereas high population densities (greater than 450 per one-half pint of soil) resulted after 'Clemson Spineless' okra or 'Kirby' soybean. Similar patterns in densities of root-knot nematodes were evident in a crop of eggplant planted in the 1994 season following each of the rotation crops.

The rotation crops planted during 1993 had little effect on yield of eggplant in 1994. Eggplant yield was inversely correlated with preplant densities of sting nematode, but not with the initial density of root-knot nematode.

Microplots (small field plots) were used from 1991-94 trying to determine the effects of 12 summer crop rotation treatments on population densities of the peanut and Southern root-knot nematodes and on yields of subsequent spring vegetable crops. The crop sequence was: (i) rotation crops during summer 1991; (ii) cover crop of rye during winter 1991-92; (iii) squash during spring 1992; (iv) rotation crops during summer 1992; (v) rye during winter 1992-93; (vi) eggplant during spring 1993.

The 12 rotation treatments were: castor, cotton, velvetbean, crotalaria, fallow, hairy indigo, American jointvetch, sorghum-sudangrass, soybean, horsebean, sesame, and peanut.

Compared to peanut, the first eight rotation treatments resulted in significantly lower numbers of the peanut root-knot nematode juveniles on most sampling dates. Soybean, horsebean, and sesame rotations were less effective in suppressing nematodes. Yield of squash was significantly greater following castor, cotton, velvetbean, and crotalaria than fol-

Project area
Integrated systems

Project duration
Dec. 1992-Dec. 1995

Budget:
SARE/ACE $155,000
Matching $184,350

lowing peanut. Compared to the peanut rotation, yield of eggplant was significantly enhanced following castor, crotalaria, hairy indigo, American jointvetch, and sorghum-sudangrass. Several of these rotation crops may provide a means for depressing the peanut root-knot nematode population densities on a short-term basis to enhance yields in a subsequent susceptible vegetable crop.

In 1993-94 the tests in microplots were designed to determine the effect of several candidate rotation crops on the Southern root-knot and stubby root nematodes. It is critical that rotation crops intended for suppression of individual root-knot nematode species be evaluated for their response to other nematode pests as well.

The fourth set of experiments was conducted in the greenhouse to determine the susceptibility of selected tropical rotation crops to two races of the Southern root-knot nematode (races 1 and 3), and the peanut and Javanese root-knot nematodes.

The series of inoculation tests included 'Rutgers' tomato and (or) 'Clemson Spineless' okra as hosts susceptible to all of the nematode populations, and 'Florunner' peanut and 'Deltapine 90' or 'Deltapine 51' cotton were included as hosts susceptible only to the peanut root-knot nematode and race 3 of the Southern root-knot nematode, respectively.

Horsebean, 'Sesaco 16' sesame, and 'Kirby' soybean exhibited intermediate levels of galling and egg mass production in response to several root-knot nematode populations.

No egg masses were observed on crotalaria, 'Hale' castor, partridge pea, 'SX-17' sorghum-sudangrass, or 'Mississippi Silver' cowpea in any of the tests. Velvetbean had only a few galls and egg masses of the peanut and Japanese root-knot nematodes, but none from either race of the Southern root-knot nematode. The response of jointvetch was similar to that of cotton, with susceptibility only to race 3 of the Southern root-knot nematode.

Since several tropical rotation crops showed resistance to several different root-knot nematodes, they may have potential use in cropping systems in the southeastern United States and other regions where these species and races of root-knot nematodes predominate.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Final Report
LS92-47

Farm Scale Evaluation of Alternative Cotton Production Systems

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Objectives

1.) Assemble integrated sustainable cotton production systems consisting of interplanting cotton into cover crops, high residue rotations, conservation tillage, high frequency deficit LEPA irrigation, predictive sequential high frequency fertilizer application and biorational insect control with ultra low volume in-canopy application equipment.

2.) Estimate the risk and environmental impact of the above practices in terms of decreased water and wind erosion, decreased nutrient leaching potential and pest management with environmentally safe chemicals.

3.) Develop an economic model that farmers can use to make decisions concerning the implementation of integrated sustainable production systems.

Approach

Dryland and irrigated cropping systems (continuous conventional cotton, wheat-cotton rotation, minimum till continuous cotton, terminated wheat-cotton, sorghum-cotton rotation and cotton-fallow-wheat rotation) were evaluated at the Agricultural Complex for Advanced Research and Extension Systems (AG-CARES) in 1993. Irrigation treatments ranged from very deficit to over irrigation (0.5 ET, 0.75 ET, 1.0 ET and 1.25 ET) based on potential ET calculated from on-site weather data. Sequential fertilizer rates were applied at 70, 85, 100 and 115 percent of the predictive amount necessary for 2-bale yields.

The crop was monitored throughout the season for possible application of various biorational pesticides. When treatable populations failed to develop, this effort was redirected to development and evaluation of a high-speed in-canopy pivot chemigation system with which to effectively apply biorational materials. The cotton stimulation model, Gossym, was also evaluated for simulating cotton development under the different cropping conditions.

Results

All irrigated minimum conservation tillage systems produced higher yields than did conventional tillage. Equivalent yields were obtained with several conservation tillage systems with 25 to 30 percent less water than was required for conventional tillage. LEPA irrigation increased cotton yields by an average of 140 lbs lint/A or 18 percent over traditional spray irrigation. The wheat-cotton cropping system produced the highest dryland cotton yield (553 lbs lint/A) and was more than double the conventional cotton yield (217 lb lint/A). It was found that the current version of Gossym does not provide sufficient flexibility in cropping systems to simulate the impact of various rotations and tillage system.

A significant speed increase (60 ft/min) was accomplished with the high speed pivot and plant coverage with tracers averaged 12 times higher with the experimental system than that of traditional chemigation application. Enterprise budgets were developed for each cropping system and irrigation level and were used in a linear programming optimization model. Depending on the irrigation water availability all optimal solutions included various combinations of the irrigated cotton-wheat and terminated wheat cropping systems and either minimum tillage or cotton-wheat dryland systems.

Optimal solutions of the model never included conventional cotton production practices. In addition to the economic advantages, lower residual nitrate concentrations measured in the root zones of the wheat-cotton cropping systems indicate that these systems along with some degree of deficit high-frequency irrigation and prescription fertilizer application can reduce nitrate leaching potential significantly. This is in addition to decreased wind and water erosion from the high residue rotations.

Two county meetings with total attendance of 85 and two field days with total attendance of about 140 were held to demonstrate the cropping system tests being conducted. In addition, an annual report was prepared and distributed to the area farmers and agribusinesses and also made available to the public through County and District Research and Extension Offices.

Implications

Test results support the concept of reduced tillage as a means to conserve moisture, reduce

Project area

Farm scale systems

Project duration

February 1993-January 1994

Budget:

SARE/ACE	$60,000
Matching	$112,300

production costs, and increase farm profitability. The positive net returns per acre for all alternative rotational dryland systems compared to a loss for conventional tillage production is economically significant.

The irrigated terminated wheat system, which provides cover during the spring period when potential wind erosion is highest, also produced higher returns per acre than the conventional tillage system, showing that reducing soil erosion while maintaining profitability are both possible. This was reinforced in the optimization model by the fact that conventional cotton production systems were never a part of the optimal solution but only those involving irrigated terminated small grain or rotation with small grain and dryland minimum tillage.

Lower residual nitrates concentrations in the root zone of the wheat/cotton conservation tillage systems indicate that these systems along with some degree of deficit high frequency irrigation and prescription fertilizer application can drastically reduce the potential for nitrate leaching.

Additional improvement and successful testing of a continuous move high speed pivot for ultra low volume chemigation and earlier successful results with a biorational material applied in reduced application volume are very encouraging as to future successful pest control with numerous biorational pesticides.

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Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
LS92-48

Developing Environmentally Sound Poultry Litter Management Practices for Sustainable Cropping Systems

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Project area
Waste management

Project duration
Feb.1, 1992 - Jan.31, 1995.

Budget:
SARE/ACE $140,000
Matching $116,669

Objectives

Many broiler enterprises produce excess manure for environmentally safe recycling in cropping systems on available land under their control. Application rates and frequencies are often excessive. Including cover crops in rotational cropping systems, such as vegetables followed by grass forage for temporary grazing, hay, or silage, may enable producers to apply litter at higher rates more frequently, and reduce nutrient losses due to runoff.

The objectives of this study are:

1.) Evaluate the environmental and economic impact of broiler litter application rates and frequencies on selected vegetables.

2.) Investigate the feasibility of growing warm and cool season annual forage crops in rotational cropping systems to remove excess nutrients supplied by poultry litter.

3.) Determine nutrient loss due to runoff in a vegetable, forage, litter management system.

4.) Demonstrate economic litter management practices on grower-owned land under grower conditions.

Approach

The litter rates applied for all objectives were based on soil test nitrogen (N) requirement of the crop and percent N content of the litter. Treatments were incorporated immediately after application by power tilling.

In objective 1, litter was applied at the recommended rate or at 2 or 4 times the recommended rate and either all pre-plant or half preplant and half sidedressed. Throughout the study, sweetcorn was the spring crop followed by broccoli in the fall. Data were collected on crop yield, nutrient uptake, nutrient accumulation, and nutrient leaching. Information gained to date indicates that producers could apply all the litter preplant or in split application without affecting growth or yield of either the spring or fall crop. Increasing litter application at more than twice the recommended rate decreased yield. Applying litter in excess of the recommended rates increases the risk of nitrate leaching into ground water. Regardless of rate applied, phosphorus (P) continued to increase in the surface 6 in. of soil. This suggests the possibility that contamination of surface waters might occur after years of continued applications of litter on sandy soils.

Treatments in objective 2 consisted of cropping system (spring veg.-fall veg., spring forage-fall veg., spring veg.-fall forage) with litter applied at either 1 or 2 times the recommended rate. Litter was applied in the spring, fall, or spring and fall. Tomatoes were the spring vegetable crop followed by turnips in the fall. Sorghum-sudan was the spring forage crop with Elbon rye planted in the fall. Data were collected on yield, nutrient uptake, nutrient accumulation and leaching. Data from this study to date indicate that litter applications in both spring and fall increased yields of vegetable and forage crop. Producers utilizing a system of spring vegetables followed by fall forage could reduce leaching of nitrogen through the soil profile as well as reduce phosphorus accumulation in the surface 6 in. of soil.

In objective 3, cropping systems of spring vegetable-fall forage, spring vegetable-fall fallow, and spring vegetable-fall vegetable were studied. Fertility treatments consisting of a control, the recommended litter rate, 4 times the recommended rate, and a commercial blend were applied. The spring vegetable crop was sweet corn followed by broccoli in the fall. Sorghum-sudan was the spring cover crop. Elbon rye was seeded in the fall. Data were obtained on nitrate (NO_3^-) and P accumulation, leaching, and runoff. The data indicated that a system of spring vegetables followed by a fall forage could reduce leaching and accumulation of N. Regardless of cropping system used P will continue to increase in the surface 1 ft. of soil. A system of spring vegetables followed by fall cover greatly reduced the amount of NO_3^- in the soil solution. Very little NO_3^- and almost undetectable amounts of P were found in runoff water. This would indicate that incorporation of litter, which would be a normal practice under row crop production, would greatly reduce the chance of surface water pollution.

Results

Due to demonstrations of litter use in vegetable production, growers are beginning to utilize this nutrient source in their operations. One grower in particular utilized litter in his intensive watermelon production program (mulch, drip irrigation) and realized yields of approximately 72,000 lbs/ac. Another producer of greens and onions, has begun incorporating poultry litter into his fertility program.

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LS92-49

Organic Soil Amendments of Agricultural By-Products for Vegetable Production Systems in the Mississippi Delta Region

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Project area

Soil amendments

Project duration

January 1992-January 1995

Budget:

SARE/ACE	$140,000
Matching	$ 39,072

Objectives

There are ways to recycle and reuse agricultural wastes so they do not go to waste. This is particularly important in Arkansas where agricultural waste products are so abundant. The state's poultry and cotton industries provide good examples of the magnitude of our waste production. In 1993 Arkansas' billion broiler chickens produced 2 to 2.5 pounds of litter per bird. During ginning of the state's 1.5 million bales of cotton, 100 to 150 pounds of gin trash were produced per bale. In this project our aim has been to take advantage of the availability of these materials by putting wastes to work improving soils on small scale vegetable farms.

In this SARE/ACE funded project, university researchers and farmers are working together to evaluate availability, agroecological impact, and economic feasibility of agricultural wastes when used as soil amendments. Our research has included work with animal manures and organic wastes from processing facilities such as cotton gins, rice mills, and fisheries. The bulk of the research/demonstration work has been carried out on small scale vegetable farms operated by African American growers in eastern Arkansas' Mississippi Delta region, one of the most economically depressed areas in the US.

Approach

Field work with waste products has primarily been conducted on farm with farmers as partners. Field studies began in 1992 at the Demonstration Farm of the Arkansas Land and Farm Development Corporation (ALFDC) in Monroe County, the Harvey Williams farm in Phillips County, the Ben Anthony, Jr. farm in Lee County, and the Jim Burton farm in Monroe County. Additional sites added in 1994 were the Randy Hardin farm and the Abraham Carpenter farm in Jefferson County and the Arther Beam farm in St. Francis and the Dennis Clark farm in Mississippi County. Studies with aquaculture wastes have been evaluated on the University of Arkansas at Pine Bluff Agricultural Experiment Station.

Because of primary interest by farmers on effects of poultry litter and manure on vegetable production, most on farm work in 1992 and 1993 involved evaluations with poultry litter. Several demonstrations were made with raw litter, but a composted pelletized form was used on most of the replicated trials. Pelletized poultry litter (PPL) with NPK analysis of 4-4-4, has been evaluated with 6 farmer cooperators on cabbage, sweet potato, tomato, okra, basil, watermelon, broccoli, turnip, and collard greens production fields. Benefits of using poultry litter have been most apparent in fields that previously had been precision leveled to improve irrigation efficiency. In these fields, topsoil has been disturbed and low pH (<6) is common. Significant crop responses have also been observed with shallow rooted plants (cabbage, collards, spinach) grown in light textured soils with low organic matter.

The major low cost agricultural wastes most available in the Delta are rice hulls and cotton gin trash. Outside of the many gins and rice processing units in the region, it is common to find huge piles of raw and decomposing gin trash or rice hulls. Many processors will deliver these wastes at no charge to a farm to be spread on land as a means for disposal. One component of our research has been to determine how wastes are being used by the area's vegetable farmers. Ben Anthony routinely hauls gin trash in his pick-up truck from a local gin to his cattle pasture where cows feed on the material over the winter. By summer's end the trash has decomposed. We applied this decomposed gin trash on damaged soil on his farm in 1994. Four tons/acre increased earliness and yield of his spring transplanted cabbage. This system worked so well that Mr. Anthony plans to use it again in 1995.

Additional studies with composted gin trash have included using the material as a potting media for growing watermelon and tomato transplants on the Ben Anthony Farm. Mixed in a 2:1 combination with perlite, tomato and watermelon transplants grown in composted gin trash were equivalent in plant height and color to plants grown in standard potting me-

dia; however root development was reduced compared to the standard. This resulted in significant problems pulling the plants during high speed transplanting with mechanical transplanters. In field trials with watermelons with Dennis Clark and Ben Anthony, once transplants were set, there were no differences in yield or quality in final harvests. In other work, composted gin trash was found to be a good material for production of potted ornamental plants, Swedish ivy and wandering Jew.

Our replicated trials with gin trash and rice hulls include studies to determine effects of cotton gin trash (raw and composted) and cover crops on yield of cabbage, broccoli, southern peas, snap beans and cucumbers particularly with marginal soils. Preliminary results with gin trash indicate significant problems with weeds and plant pathogenic organisms result following use of raw gin trash. Composting alleviated these problems.

In one ALFDC farm demonstration, the negative effects of application of raw rice hulls were demonstrated with spring transplanted cabbage when rates up to 10 tons/acre raw hulls resulted in nutritional deficiencies (primarily N). This demonstration was valuable to several farmers and area extension agents who had routinely recommended rice hulls for garden plots.

Work with aquaculture wastes has included construction of composting units at the UAPB Aquaculture Research Station. Dead fish and remains along with spoiled feed are composted on site. Evaluations of finished compost have been made in replicated field trials with collards and southern peas at the UAPB Research Farm.

Hairy vetch and rye were evaluated as winter cover crops in combination with compost. Cover crops had varying effects on southern pea yield in 3 years of trials, but there was no significant difference in yield associated with addition of 2 tons compost/acre. With spring transplanted collards in 1994, 2 tons compost/acre significantly increased yield.

Education and outreach is an important part of our project. Researchers and farmers have participated in several workshops and conferences including the ALFDC Annual Conference in Fargo, AR held each October. In 1994 our research was highlighted in a special sustainable agriculture section held during the conference which included tours of research plots. Additional field days were conducted on the Ben Anthony and Abraham Carpenter farms in 1994.

Results

In this project, we have found that benefits from applying low cost agricultural waste products include improvements in soil productivity and possible increases in farm profitability.

The most outstanding results have been observed with crops grown on land that had been recently precision leveled and with crops with shallow root systems. An additional benefit is the contribution to solving waste disposal problems confronting the region. Further studies are planned for 1995.

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Final Report
LS92-50.1
LS94-50.1

Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education

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Soil Conservation Service

Environmental Protection Agency (Regions IV and VI)

Staff from nearly all 1890 and 1862 land grant universities in the South

Objectives

The overall objective of the project is to organize a comprehensive, region-wide description of the "State of the South" in sustainable agriculture. This description will include the key constraints to increased sustainability of Southern agricultural systems and the best opportunities for research and education projects to remove those constraints.

This overall objective is being pursued through four specific objectives:

1.) Determine constraints by means of focus groups in all important Southern agroecoregions.

2.) Determine opportunities through opportunity workshops and associated farmer-researcher networks in the major Southern agroecoregions and around key regional cross-cutting constraints.

3.) Comprehensively survey key agricultural and environmental groups in the South to assemble quantitative data on constraints and opportunities for sustainable agriculture research and education.

4.) Integrate and analyze all available secondary databases analysis related to major constraints to sustainability of Southern agricultural systems and the best opportunities in research and education for removing those constraints.

Approach

"State of the South" contains four major components: focus groups for in-depth, qualitative analysis of constraints; GIS/secondary database analysis, a region-wide survey, and opportunity workshops as part of farmer-researcher networks. The survey received responses from 1189 counties of the 1402 counties in the South. In six key agroecoregions, county Farm Bureau Presidents, Sierra Club members and New Farm subscribers were also surveyed. Due to the participation of state extension directors, several states can boast of a 100% return rate from county extension offices. Over 700 farmers have participated in 50 focus groups. Specific methods are discussed in the full report on file in the SARE/ACE office.

The GIS component has progressed less quickly due to lack of easily aggregated county-level data. GIS activities are also summarized in final report and includes 15 maps.

Agencies across the South held opportunity workshops in nine locations this past year. These workshops are detailed in the full report. Five workshops focused on opportunities peculiar to their agroecoregions (including Delta, Coastal Plains, Karst, High Plains, Blacklands). Four others addressed major cross-cutting constraints—in Austin, systems beyond the farm level will be examined (including marketing, commodity programs, rural development approaches and research/education paradigms; in Memphis (rural development, especially catalyzing locally-owned, value-added enterprises); vertical integration; and Williamsburg, VA: local food systems—especially organic and semi-organic systems near urban areas.

Results

One vision for the South is common to the thousands of farmers, researchers and environmentalists who participated in "State of the South" focus groups, surveys and workshops over the past three years: a clean environment, strong family farms and vital rural communities. And nearly all feel, with strong public research support, this vision can be achieved. However, these goals won't be achieved by a few new production-oriented research and education projects.

Instead, a major restructuring of agricultural research and education system is required in the South. The prerequisite for this restructuring is a unity of farmer and environmentalist perspectives. The polar attitudes of many in these groups thwart progress toward unity. County-level staff can facilitate such unity by learning methods of creative synthesis of ideas. "None of us have all the answers, we all need to learn from each other," reflects the professional stance which leads to the synthesis of farmer and environmentalist perspectives.

A second conclusion of the 9 farmer-researcher opportunity workshops held from December 1993 to July 1994, is that sustainable production is increasingly impossible without marketing alternatives—especially locally-owned, value-added (LOVA) enterprises. Where success has been achieved on this front,

Project area
Needs survey

Project duration
February 1992-June 1995

Budget:

SARE/ACE	$241,230
Matching	$157,500

it is with non-traditional agricultural research and education methods. Focus groups, workshops and the survey were unanimous in advocating more research and education into creation of alternative markets.

Progress in marketing will require changing from a commodity focus to a product focus. Southern agricultural research and education staff can best assist by applying methods from entrepreneurship research for innovating production/marketing systems to anticipate and respond to consumer needs. Catalysis of LOVAs would be facilitated by an integration of production and marketing research. New research tools, such as decision cases, will be required.

A third conclusion common to these workshops is: Southern farmers organize hugely complicated systems and increasingly need research/education efforts which take a holistic systems approach. The key for researchers is not to focus on components so narrowly that the emerging properties of the whole farm or enterprise become ignored. Soil biology certainly is a top specific agronomic priority, especially when integrated with work on cover crops and pest control. But a narrow focus on improving soil quality can easily miss the target. Part of the problem is looking for "the key" rather than looking to increase the overall resilience of the system by generating multiple options and thereby flexibility for farmers. Changing the research reward system, especially expanding peer review panels to farmers and other systems managers, will be crucial to accomplishing this objective.

Following are more opinions strongly expressed through the focus groups:

4. To increase sustainability, we must increase farmer resilience. To increase resilience, we must increase flexibility. To increase flexibility, we need to increase options available to farmers. Any limits on sources of options will limit the possibilities for farmers. County-level staff can assist by taking a professional stance of empowerment of their farmer clients. The goal of the empowerment model of technical assistance is to help farmers and other clients become the hubs of multiple information sources. One aspect is encouraging farmer to farmer information exchange. Another is facilitating farmer-researcher networks.

5. The indicator of success most important to Southern farmers is the condition of their assets. If new options lead to increasing assets (including soil, equipment, financial assets, biodiversity and new joint business ventures), they will be likely lead to increased sustainability of Southern farmers.

6. The best route to increasing marketing options for sustainable products lies through strengthened ties between farmers and consumers. Efforts to create more local food systems are one part of this effort, as are efforts to achieve farmer-environmentalist unity on policy issues, and efforts to integrate production and marketing to achieve continual innovation toward consumer satisfaction.

7. In marketing, engendering LOVAs means building technical assistance to farmers around the experiences of those farmers who have established and are running LOVAs themselves. Direct farmer involvement is crucial in any research, especially marketing research, undertaken to support such a technical assistance program.

8. The vast changes occurring in Southern agriculture, especially toward vertical integration, are viewed as a threat to be stopped by some. But to increasing numbers of Southern farmers, vertical integration is an innovation to be learned. The problem of turning these threats into opportunities through research and education is that no standard methods have yet emerged in agriculture for examining such emerging innovative systems holistically. The method of decision cases, long accepted in business and law is beginning to achieve inroads in agriculture. It represents both an educational tool and a potential research method for examining such systems.

Flexible research and education systems willing to explore new and multiple perspectives are essential to creating and taking advantage of evolving opportunities. To assist in opening up new options, the latest report of the State of the South project goes beyond a summary of the set of specific opportunities generated by State of the South focus groups and opportunity workshops. The goal of this report to use these specific results to present a holistic systems approach to innovation. This approach is the product of the three year "State of the South" attempt to base research and education priorities on the decision-making needs of farmers and other systems managers.

Southern agricultural systems are changing rapidly. But within all chaos lies the certainty of creative, powerful new systems. Sustainable agriculture research and education can help farmers organize those systems to provide both a sound rural economy and a clean environment in the South.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Final Report
LSE92-1

Southern Region Sustainable Agriculture Workshop

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Objectives

1.) Identify, develop and facilitate the adoption of environmentally sound, profitable, and socially acceptable production systems emphasizing ecological and biological principles.

2.) Assist farmers and consumers in understanding risk assessment, management and communication in the context of sustainable agriculture systems.

3.) Enhance producers' understanding of the concerns and importance that the consuming public places on a safe food supply.

4.) Aid producers in developing alternative sources of income.

5.) Enhance producers' attitudes and management of labor and worker health and safety.

With these overall objectives in mind for advancing the acceptance of sustainable agriculture concepts in the region, the following purposes were formulated for the workshop:

1.) Build state coalitions to address sustainable agriculture and its impact on research and education in the Southern Region.

2.) Education and discussion on sustainable agriculture.

3.) Sharing educational materials among states.

4.) Sharing research conducted in the region on sustainable agricultural systems.

Approach

A Southern Region Sustainable Agriculture Workshop was held March 7-9, 1993 at Callaway Gardens, Pine Mountain, GA. The workshop was originally proposed by the SR ANR Program Leaders, and had programming support from ES-USDA and CSRS-USDA. Southern Research and Extension Directors approved the activity as a Southern Extension and Research Activity-Conference (SERA-C).

The planning committee was composed of diverse representatives from the farming community, agribusinesses, non-profit organizations, government agricultural agencies, farmer organizations, foundations and land-grant universities. The primary purpose was to foster building state coalitions to address sustainable agriculture and its impact on research and education in the region. The workshop planners desired a diverse audience, but set a goal that at least one-third of the participants would be farmers. To this end, the planners asked state ANR Program Leaders to invite 15-20 people with diverse interests from each state. About 200 people attended the workshop, and several Program Leaders were able to obtain funding for many of their farmers to attend.

The program consisted of presentations on the role of sustainability in agriculture in the future, teamwork approaches in sustainable agriculture programs, and the future of sustainable agriculture from the federal perspective. Panel discussions were used to react to presentations and to "bridge" to subsequent group discussion activities. Group breakout discussions dealt with the following questions:

* What constrains agriculture from being sustainable?
* What needs to be done to improve the sustainability of agriculture?
* What collective action is needed to make necessary changes to improve education and research in sustainable agriculture, including developing state strategies?

Results

Evaluations indicated that the workshop was successful in helping people move toward building state coalitions to address sustainable agriculture, especially the sessions dealing with teamwork. Over 90 % of the participants indicated the workshop provided program ideas that would be useful to them. Ninety-two percent of the attendees evaluated the workshop as "an outstanding program..." or that "many parts were valuable..." The evaluations also indicated that planning for future workshops should include more attention to facilities selection, choices of speakers, handout materials, audio-visual aids, audience diversity, and the need to continue to foster positive dialogue among persons with diverse interests.

The five objectives given in the proposal are the long term objectives for regional, state and local education and research programs in sustainable agriculture identified by the original planning committee and the ANR Program Leaders. The specific purposes of the work-

Project area
Education

Project duration
July 30, 1992 - July 31, 1994

Budget:

SARE/ACE	$5,000
Matching	$10,000

shop are addressed here in terms of initial background efforts to begin coalition and team building to help address the overall objectives of sustainable agriculture programming.

Purpose 1: To build state coalitions to address sustainable agriculture and its impact on research and education in the Southern region

The planning committee put in place a participatory workshop program to help change peoples' attitudes toward working with diverse groups to build coalitions. State discussion groups were specifically aimed at providing an opportunity for the states to begin developing a team effort to address sustainable agriculture in their research and education programs.

Over 96 % of the participants indicated that the workshop helped them identify strategies to help build effective coalitions in the states. Over 90 % of the participants indicated that the small group discussions were good or excellent in helping their understanding of teambuilding and addressing sustainability issues. The presentations on "Teamwork approaches to more sustainable agricultural programs" were rated "useful" or "very useful" by over 70 % of the participants.

Purpose 2: To enhance peoples' understanding of sustainable agriculture

Many of the discussions and presentations, both formal and informal, during the workshop dealt not only with coalition building, but also the broader philosophies and concepts of the sustainability issue. The keynote address and panel reactions dealt specifically with the issue of sustainable agriculture and its implications for the future. In addition, the breakout group discussions addressed the constraints, opportunities and strategies associated with sustainable agriculture on the research and educations fronts. Over 90 % of the attendees indicated that the workshop provided useful program ideas and that the workshop enhanced their knowledge of sustainable agriculture in the region. The workshop planners hope this workshop was, and is, viewed as a beginning of a viable and visible program in sustainable agriculture in the region.

Purpose 3: To share educational materials

Most states and some organizations participating in the workshop shared publications and other materials with fellow participants at the workshop. The evaluations did indicate that for future workshops, the speakers should provide for more effective and consistent use of handout materials.

Purpose 4: To share research results

All state were invited to, and about half the states did, share poster presentations of sustainable agriculture programs. These presentations were available throughout the workshop for viewing and discussion by the participants. Future workshops or conferences should put additional focus on sharing activities such as poster presentations.

Dissemination of Findings

A tabloid, "Rural Postscript—Highlights of a Sustainable Agriculture Workshop" was published in June, 1993. The tabloid was distributed to participants, supporters, sustainable agriculture leaders and others. In addition, land-grant universities in each state and territory received a supply of the tabloid for their use.

"Proceedings of the Southern Region Sustainable Agriculture Workshop" was published in September, 1993. It was distributed similarly to the tabloid, with the exception that bulk quantities were not sent to the landgrant universities. They were invited to request additional copies for their use if needed.

SARE/ACE
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Annual Report
LS93-51

IPM for Nematode Disease Control in Vegetable and Agronomic Crops in Florida and Alabama

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Abstract

Field experiments with castorbean (*Ricinus communis*), american jointvetch (*Aeschynomene americana*), hairy indigo (*Indigofera hirsuta*), partridge pea (*Cassia fasciculata*), sesame (*Sesamum indicum*), bahiagrass (*Paspalum notatum*), velvetbean (*Mucuna deeringiana*) were established to assess their value as rotation crops for control of root-knot nematodes (*Meloidogyne* spp.) and other soilborne pathogens of cotton, peanut, or soybean. Experiments were in producer farms and in fields within the Alabama Agricultural Experiment Station system. In peanut experiments all rotation crops were suppressive of root-knot nematodes which resulted in marked increased in yields of peanut following the crops. Yields of soybean and cotton following bahiagrass were much superior to those obtained with monoculturing of these crops. Planting of velvetbean before soybean also improved soybean yields and reduced damage from root-knot nematodes and *Neocosmospora vasinfecta*. Economic analysis of sesame indicated that it was a crop that could be grown advantageously under Alabama conditions. In 1994, two producers in Geneva county, Alabama, planted sesame on 700 acres with satisfactory results. Other disease suppressive crops uncommon to Alabama and used in this project are currently being studied to develop systems practical for our producers.

Objectives

Root-knot nematodes (*Meloidogyne* spp.) are frequently the major pests of cotton, peanut, soybean and vegetable crops in the southeastern United States. The most frequent species in the area are: *M. arenaria, M. incognita,* and *M. javanica*. Often these pathogens occur in the same field together with other soilborne plant pathogens (e.g. *Fusarium* spp., *Rhizoctonia solani*, *Pythium* spp, *Neocosmospora* spp., etc.) and yields can be reduced to such an extent that economic production in a monoculture system is not possible. Crop rotation and genetic resistance are currently the only major management tools available that are effective and economical in fields where mixed populations of *Meloidogyne* spp. and other pathogens occur. Preliminary data indicate that many traditional as well as other crops uncommon to the southeastern United States can be used to manage damage caused by nematodes and other soilborne plant pathogens. There is nevertheless need to assess the relative efficacy of rotation systems for control of root-knot nematodes and other pathogens in field conditions similar to actual producer situations. To this end a two year study was performed to obtain additional information on crop yields, efficacy, and economics of selected rotation systems with traditional and uncommon crops in the principal Alabama field crops.

Approach

Field experiments in Alabama were established at the Wiregrass substation (peanut), at the E.V. Smith Center (cotton), and in two producer fields near Elberta, Baldwin county. In addition, three microplot experiments were conducted in the 'Old Agronomy Farm' on the Auburn University campus. Each experiment consisted of 8-10 treatments with eight replications (plots) each, arranged in randomized complete block design. Field plots (experimental units) were each 8-row wide x 33 feet (10M) long; microplots consisted of a 1 ft^2 area delimited with chimney flute as described in previous publications. In each experiment data were collected on numbers of plant parasitic nematodes, disease incidence, and yield. All data were analyzed according to standard procedures for analysis of variance.

Results

Castorbean and velvetbean were the most root-knot suppressive and yield enhancing in rotations with peanut. Roots of both castorbean and velvetbean are known exude compounds that are nematicidal or nematostatic. There is also evidence that the bacterial microflora of these plants is abundant in species antagonistic to root-knot nematodes. These results confirm findings in Brazil, Central America, and Mexico where the value of velvetbean to manage nematode and disease problems has been amply demonstrated. Velvetbean was once the premiere green manure crop in the South and was used in Alabama not only to improve fer-

Project area
IPM

Project duration
Nov. 1992 - Nov. 1994.

Budget:

SARE/ACE	$16,000
Matching	$11,700

tility but also to manage soilborne pathogens and reduce weed problems.

Yield of peanut following sesame, hairy indigo, american jointvetch, or partridge pea were also significantly improved. Partridge pea was allelopathic to weeds so that plots with this legume were essentially free of this problem. Green manure production from hairy indigo and american jointvetch was outstanding exceeding in most cases 10 MT dry matter/ha. Sesame proved to be the most interesting rotation crop from an economical point of view. There is significant demand for the crop in the national and international markets. In 1994 two producers in Geneva County planted 700 acres of the crop with satisfactory results in spite of adverse weather conditions.

Results from soybean experiments in Baldwin county confirmed the value of velvetbean for the management of nematode problems. Yields of soybean following velvetbean were markedly improved. This was true for all cultivars tested in fields infested with a mixture of *Meloidogyne* spp. and the cyst nematode, *Heterodera glycines*. It is noteworthy that all cultivars tested in these experiments responded to the velvetbean rotation regardless of their level of resistance to the nematodes.

Bahiagrass pasture improved yields of cotton and soybean following it. This was true for all cotton and soybean cultivars tested. At the E. V. Smith center, the bahiagrass rotation improved the height and degree of mycorhization of cotton plants suppressed significntly fusarium wilt problems. These results corroborate earlier studies in Alabama and other southeastern states.

Microplot experiments at the Auburn campus demonstrated that castor, velvetbean and hairy indigo could be used advantageously to suppress root-knot problems and enhance yields of Black Beauty eggplant following these crops.

In conclusion, our studies showed that:

a.) It is possible to increase crop yield and manage nematode and other soilborne disease problems by using crop rotations

b.) Several "exotic" crops, e.g. sesame, velvetbean, can be used economically to improve yields in the southeastern U.S.A.

c.) Rotation crops tested in our study can be incorporated into existing production system with minimal requirements in equipment or modification of cultural practices. There remains need to determine the best cultivars and information on specific cultural requirements for optimal production of "exotic" crops under Alabama conditions.

Impact of Results

Results showed conclusively that it is possible to manage soilborne disease problems of cotton, peanut, soybean and eggplant in Alabama through the use of rotation systems.

For cotton and soybean rotation studies indicated that when a rotation was effective then the choice of cultivar was not that important, i.e., cultivars resistant or susceptible to root-knot nematodes (cotton) or to root-knot nematodes and the cyst nematodes (soybeans) performed equally well when following the rotation crop.

Sesame and velvetbean were the most economically attractive among the "exotic" crops tested. Peanut-sesame rotation would make peanut production competitive at prevailing world market values. Hairy indigo and american jointvetch were notable for the production of large amounts of green leguminous matter.

Sesame was tried on 700 acres by two peanut producers in Geneva County, Alabama, with satisfactory results. This was in spite of bad weather conditions and the fact that there is practically no knowledge in Alabama with respect to cultivars or cultural practices for optimal production of the crop.

Future research should be directed to the integration of "exotic" crops into our production systems. There is great need to screen existing cultivars of these crops to determine which are the most adequate to the Southeast.

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Annual Report
LS93-52

Utilization of Dairy Manure in Low-Input, Conservation Tillage Animal Feed Production Systems

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Objectives

Scientists and farmers have known for decades, even centuries, that animal manures enhance the growth and yield of plants. However, relatively little has been done to enhance the producer's ability to utilize this important resource wisely. It is not uncommon for a dairy farmer to spread manure on his fields and then apply nearly full recommended rates of inorganic N (and P and K) to the field. If asked for a reason, most will indicate that they do not know how much N, P, or K was in the manure, so they must "insure" good yields through the application of inorganic fertilizers.

Over-application of nutrients poses at least two problems: first, excess nutrients can leach or runoff into water supplies, causing health problems or at least imbalances in aqueous ecosystems; secondly, applying inorganic fertilizers when manures are available is an economic loss for the farmer. Therefore, it is important to provide tools to make wise resource use decisions to save money and to improve environmental quality.

This objectives of this research project are to look at the long-term residual impacts of manure applications on corn silage growth and soil properties, as well as the impact of manure applications on off-site surface and subsurface water quality.

This is being accomplished through the use of field plots at two State Agricultural Experiment Stations and two cooperator farmer locations. The Experiment Station sites are the Martin Agricultural Experiment Station in Martin (northwest Tennessee) and the Dairy Experiment Station in Lewisburg (south-central Tennessee). The plots at Martin have not received previous applications of manure, while the Dairy site has been manured frequently for nearly 40 years. The farm sites are both working dairies, one near Martin, and the other south of Lewisburg.

Approach

In order to evaluate residual availability of N on manured plots, plots were established in 1993 at the Experiment Station sites and in 1994 at the farmer sites. The experiment at the Experiment Stations consists of 17 treatments: a 0-fertilizer check, three rates of N as NH_4NO_3 (84, 168, and 252 kg N ha^{-1}), and three rates of manure N (112, 224, and 336 kg manure-N ha^{-1}) applied for either 1) three consecutive years, 2) two consecutive years + no application in year three, or 3) the first year with no application for years two and three. To provide a tillage comparison, the 168 kg inorganic N ha^{-1} and the 224 kg manure N ha^{-1} treatments applied for one, two, or three years were established with conventional tillage (chisel + disk + harrow) and no-tillage.

Manure rates were derived using the assumption that 75% of the N applied as liquid cattle waste would be available for plant use in year one (Pratt et al., 1973). This results in an estimated availability of 84, 168, or 252 kg N ha^{-1} which matches the inorganic rates. The 168 kg ha^{-1} rate corresponds to the high end recommended rate of fertilizer N for corn in Tennessee.

Inorganic P_2O_5 and K_2O are applied to the inorganic fertilizer N plots according to soil test recommendations. Manures and fertilizers are applied prior to tillage and planting operations. Smaller versions of this experiment have also been established on two cooperator farm sites, one in each region. The treatments were scaled down to the following 11 no-tillage treatments: the 0-fertilizer check; the 168 kg NH_4NO_3 N ha^{-1} treatment; and the 112, 224, and 336 kg manure N ha^{-1} treatments for one, two or three years.

To evaluate manure impacts on water quality, a second series of plots were established at each Station. Treatments at the Martin site include four rates of liquid dairy manure (126, 252, 380, and 504 kg N ha^{-1}), one NH_4NO_3 rate (218 kg N ha^{-1}) and a control (0 kg N ha^{-1}). At Lewisburg, the 380 kg N ha^{-1} manure treatment was omitted due to lack of space. The applications range from deficient to excessive N rates; however, the high application rate is not uncommon for dairy operators in these areas.

Corn for silage is no-till planted on all plots each spring, followed by an annual ryegrass-clover winter cover at Martin and orchardgrass cover at the Dairy Station.

Instruments have been installed beneath each plot (at a depth of three feet) to collect

Project area
Livestock systems

Project duration
July 19 93-July 1997

Budget:
SARE/ACE $90, 635
Matching $36,123

water leaching through the soil and out of the root zone. After every storm, leachate is analyzed for nitrate-nitrogen and other constituents, such as phosphate.

Results

The data for the residual experiments indicate that prior manuring history will affect the availability of N. At Martin, yields of silage corn were much lower for second year corn grown on plots receiving manure only during 1993. For soils receiving manure for two years, the yields approached those from the inorganic N treatments. For example, 168 kg N as ammonium nitrate resulted in yields of approximately eight tons of dry matter per acre, while the 224 kg N as manure resulted in a yield of approximately six tons of dry matter per acre. However, soils that have received manure for many years may not respond further to nutrient additions for some period of time.

After two years at the dairy site, there have been no yield differences between plots receiving no nitrogen, manure for one or two years, or inorganic N fertilizer. Yields this year averaged approximately five tons of dry matter per acre.

Water quality monitoring at Martin has indicated that rates of manure nitrogen as high as 250 kg per hectare (225 lbs per acre) results in yields comparable to those using recommended rates of inorganic N fertilizers (approximately 168 kg per hectare) with no significant impact on nitrate-N concentrations in the leachate. Cumulative nitrate-N losses are much higher from plots receiving over 500 kg N per hectare per year and may pose a problem.

Observations at the Dairy Station for the last few years indicate that there is appreciable N being made available from prior manure additions, and leaching losses have occasionally been unacceptable even from 0 N control plots. Again, these data indicate that we will need to closely evaluate the previous history of a farm when deciding how much N or P we will add in any form.

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Sustainable Whole Farm Grain/Silage Production Systems for the Southeast

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Project area
Whole farm systems

Project duration
June1993-May1997

Budget:
SARE/ACE $240,639
Matching $218,600

Objectives

1.) Develop profitable alternatives, using white lupin, tropical corn, and hybrid pearl millet to current grain and silage production systems employed by farmers in the Southeast.

2.) Develop sustainable systems utilizing these alternative crops that integrate into diversified (crop/livestock) farming systems and result in reduced pesticide and fertilizer inputs and conservation of soil, water and energy.

3.) Determine the profitability of production systems using these alternative crops as compared to traditional systems currently employed by farmers in the Southeast and disseminate this information to farmers through farm meetings, popular press articles, extension publications, videos and television.

Approach

Coordinated experiments are being conducted at five locations in Alabama, Florida, and Georgia extending from the panhandle of Florida to the northern edge of the Coastal Plain in central Alabama. The core experiment is a cropping systems experiment of six cropping systems in conjunction with four rates of nitrogen (N) fertilizer applied to the summer crops in the systems.

Cropping systems are:
1. Wheat/soybean
2. Wheat/tropical corn
3. Wheat/pearl millet
4. Lupin/soybean
5. Lupin/tropical corn
6. Lupin/pearl millet

Nitrogen treatments on summer crops are 0, 60, 120, and 180 lb N/acre. This brackets recommended N rates for these crops under rainfed conditions.

The changes in amounts of nitrogen in the plant/soil system will be measured from the beginning of the study in 1993 until the end of the study in 1996. This will provide information on N utilization efficiency of the systems and allow inferences to be made as to losses of N to the environment via denitrification, runoff and leaching.

Whole plant samples of lupin, pearl millet, and tropical corn are collected at appropriate growth stages for each crop for silage yield determinations. Silage quality is from these crops is determined (measurements of DM, ADF, NDF, IVDMD, CP, and Ash, and ensiling evaluation- pH, DM, lactic acid in laboratory mini-silos) is made each year. Data collected includes yields and all production inputs and values necessary for accurate economic analyses. Enterprise budgets will be developed to determine the most economically viable cropping system.

In addition to the primary test, separate but coordinated studies include:

1.) Experiments to determine the optimum planting dates for tropical corn and pearl millet;

2.) Animal feed trials to evaluate silage of the three alternative crops- tropical corn, pearl millet, and lupin;

3.) Experiments to determine the effectiveness of the biological insecticide, *Bacillus thuringiensis* Berl., for control of fall armyworm in tropical corn;

4.) Characterization of potential insect pests of pearl millet;

5.) Evaluation and screening of new lupin germplasm;

6.) Evaluation of the potential forage value of new pearl millet hybrids;

7.) Determination of optimum soil pH and phosphorus needs of pearl millet;

8.) The role of phosphorus nutrition in seed quality of white lupin.

Results

Results varied due to location and rainfall patterns but preliminary data indicate that:

1.) The short growing season of pearl millet should fit well in double-cropping systems with lupin;

2.) Previous winter crop, i.e., wheat or lupin, had no effect on subsequent soybean yields.

3.) Tropical corn yielded from 6.6 to 26.8 tons/A silage dependent on location, rainfall, N fertilizer rate, and previous winter crop.

4.) Tropical corn silage yield following a failed crop of lupin was increased by 5.2 tons/A compared to following wheat when corn was not fertilized with N. This indicates a poten-

tial risk aversion benefit of lupin due to its alternate use as a green manure in years when grain or silage crops are failures.

5.) Tropical corn grain yields were highly dependent on rainfall and planting date.

6.) Under favorable conditions, tropical corn grain yields responded to rates of N fertilizer as high as 180 lb N/A regardless of whether it followed wheat or lupin, peaking at 90 to 100 bu/A.

7.) Pearl millet silage yields were generally less than half (4.3 to 11.2 tons /A) that of tropical corn but equivalent yields were obtained in one instance (25.6 tons/A).

8.) Pearl millet silage and grain yields responded to rates of N fertilizer from 120 to 180 lb N/A dependent on environmental conditions and previous winter crop. This refutes conventional recommendations that millet has a low N fertilizer requirement.

9.) Grain yield of pearl millet was slightly greater following lupin than wheat when not grown under severely limiting environmental conditions.

10.) Bird predation in small plot research is a serious problem, but estimated grain yields of millet ranged from 25 to 98 bu/A.

11.) Wheat yields were greatest following soybean (83 bu/A in one case) but equivalent yields could be obtained following millet and tropical corn if these two crops were fertilized with 120 to 180 lb N/A.

12.) At one location under favorable conditions, lupin yielded 8.1 tons silage/A and 34 bu/A grain (58 lb/bu).

13.) Tropical corn, lupin and pearl millet were ensiled satisfactorily.

14.) Tropical corn silage was comparable to temperate corn silage in quality.

15.) A short-term preliminary study suggested that feed intake and milk production was similar for cows fed lupin silage supplemented with corn grain or cows fed standard temperate corn silage.

16.) Experimental hybrids of pearl millet showed increased forage quality (IVDMD) over the standard commercially available pearl millet hybrid HGM 100.

17.) Optimum pH for millet grain production was between 6.0-6.5 and millet responded to soil test P up to a level rated "high" by the Auburn University Soil Testing Laboratory.

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Evaluation of a Low-input, No-till, No-herbicide Continuous Grazing System for Dairy Cows

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Project area

Livestock system

Project duration

July 1993 to August1996

Budget:

SARE/ACE	$118,911
Matching	$62,700

Objectives

The objective of this project is to evaluate the economic impact of implementing a year-round rotational grazing system utilizing sustainable agriculture techniques.

Approach

This project is being conducted by Clemson University at the Tom Trantham Dairy, located 35 miles from campus. Mr. Trantham milks approximately 72 Holstein cows twice per day. A system has been designed with the goal of utilizing grazing during as much of the year as possible. Mr. Trantham's dairy has been divided into eight pastures. This reports summarizes data obtained from the spring and summer crops of 1994. All crops during this time were planted using no-till methods. Crops grazed during the spring were mostly cereal grains and ryegrass, and crops grazed during the summer were sorghum and millet.

Manure was used as the main source of fertilizer. Organic nitrogen was used sparingly as needed so as not to sacrifice the health of the plant. Usually, pastures were subdivided by movable fence into paddocks of two to five acres. If the forage supply was low, the entire pasture was grazed. Number of days grazed per paddock was minimized so that crop growth did not preclude accurate estimates of dry matter intake based on pre-graze and post-graze clippings. Cows grazed from one to five hours per day, depending on the forage supply. Cows were kept on each paddock for an average of 4.8 days. Once cows started grazing on March 15, 1994, they grazed 161 of the 216 days through October 16, 1994.

Dry matter and nutrients grazed were obtained by collecting ten pasture samples immediately prior to grazing and immediately after grazing ceased. Samples were taken in a pattern so they were representative of the entire pasture. Each sample was obtained by clipping all forage growth contained within a two-foot by two-foot metal frame that was placed on the ground. Plants were clipped so that approximately two inches of stubble remained. Samples were transported to the laboratory and analyzed for nutrient content.

The advantage of grazing was determined by subtracting the estimated costs for feeding the herd without grazing from the actual costs of the feeding program utilizing grazing.

Results

Cows grazed 161 out of a possible 216 days. They grazed the spring crop for 96 days and the summer crop for 65 days. On days they grazed, cows consumed an average of 10.5 pounds of dry matter from grazing. This is approximately 25% of their dry matter requirement. This figure varied considerably, depending on the amount of available forage.

Quality of feed consumed

Cattle that graze consume a much higher product than results if that crop is harvested. Cattle naturally choose the lushest, most nutritious parts of the plant and leave the least digestible parts. The data from the first year of this study verify this fact. For the spring crop, which consisted mostly of cereal grains and ryegrass, the crude protein content of the entire plants offered to the cows was 20.9%. However, the crude protein content of the forage that was consumed was 25.4%. Likewise, the RFV of the plant offered to the cows was 86.3 but the RFV of the forage consumed was 114.7.

For the summer crops which were mostly millet, the crude protein content of the plants offered was 20.6% and the amount consumed was 24.3%. RFV offered was 89.0 but the cows consumed portions of the plant that averaged 104.6. For the first year of the project, cows were offered pasture that averaged 20.6% CP but they consumed plant parts that averaged 24.3% CP. Overall, they were offered pasture that had a RFV of 87.6 but consumed pasture that averaged 104.6.

These data illustrate one of the unique advantages of grazing. Had the cows been fed the same crops as harvested feed, they would have been fed a much lower quality product and would have had to expend energy digesting lower quality forage.

Cost advantages of grazing

When all costs associated with grazing were calculated, data for the first year of this study show that grazing saved an average of $.56 per cow per day that cows grazed for a total sav-

ings of $6,491.52. This figure was obtained by subtracting actual costs of the entire ration, including costs of grazing, from the estimated cost of producing the same amount of milk with grazing excluded from the ration. This is a very significant amount of money that is being saved by including grazing in a feeding program.

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Cover Crop Integration into Conservation Production Systems

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Project area
Cover crop systems

Project duration
June 1993 to May 1997

Budget:

SARE/ACE	$135,540
Matching	$117,040

Objectives

The objectives of this project are to remove barriers to wider use of winter cover crops to build soil productivity, increase farm profitability, and reduce adverse environmental impacts of row-crop production. Specifically, the project seeks to

1.) Identify legume cover crop germplasm with superior reseeding characteristics.

2.) Demonstrate practical management systems that reduce the need for herbicides in no-till and low-till crop production. This project will make cover crops more attractive by reducing their cost and developing easier ways of managing them.

Approach

Cover crop nursery evaluations: Legume cover crop germplasm is screened at ten locations representing the major soil types and climatic zones (8A in southern Mississippi through 6B in northern Tennessee and Arkansas) of the region for a superior combination of winter hardiness, vigor, early maturity and hard seededness. Each fall, the project leader identifies 18 to 24 accessions and distributes small lots of seed to cooperators (farmers and researchers) who plant them in observational plots and record growth, vigor, flowering date, seed formation, and weather data. The widely-grown 'Tibbee' crimson clover is used as a check. Cover crop yield samples are taken at each location and are sent to the National Sedimentation Laboratory for nitrogen analyses. The cover crops are killed in the spring at dates controlled by the flowering of 'Tibbee,' and reseeding successes are determined the following fall.

Management system evaluations: Management systems being evaluated in replicated-plot and on-farm studies include demonstrating mechanical killing cover crops ahead of no-till planting cotton and other crops, testing planter attachments to facilitate the planting of cotton through the cover crop residues, and evaluating the ability of the residue mulches to reduce weed competition with summer crops.

A "Mowing Date Study" compared mowing vetch, rye, or rye plus vetch 0, 1, 6, 14, or 25 days ahead of no-till cotton planting in early May and tested four commercial residue management planter attachments. A "Cover Crop X Weed Control Study" compared four winter cover crops (vetch, rye, rye plus vetch, or volunteer vegetation) and four weed control treatments (ranging from no-till with broadcast preemergence and postemergence herbicides to a minimum herbicide treatment involving mechanical and flame cultivation) for cotton production. Soil temperature, cotton growth, and weed populations are measured.

In on-farm evaluations, Steve Parks and Lorna McMahon tried no-till planting corn and cotton into mow-killed rye and vetch in Tiptonville, TN; David Denton tried no-till planting soybean into mow-killed rye, vetch, or rye plus vetch, in Tyronza, AR; Jim Whitfield and John Hines compared disking, spraying, and mow-killing a wheat/vetch cover crop prior to cotton planting in Yazoo City, MS.

Results

Two promising new cover crops have been identified. Southern spotted bur clover (*Medicago arabica*), appears to be well suited to the upland soils in much of the region while 'Paradana' balansa clover (*Trifolium balansae*) has been superior on wet delta soils. Both have matured seed earlier than 'Tibbee' and both have volunteered back for two years following maturation of a seed crop in 1993. Spotted bur clover was a widely grown cover crop during the 1950's; it was a bi-product of California's barley industry that disappeared from the seed trade when herbicides cleaned up the barley crops. Because it is well adapted, it has persisted in waste areas. Seed of an accession collected in northern Mississippi is being increased in cooperation with the Natural Resources Conservation Service Jamie Whitten Plant Materials Center for possible accelerated release as a "source-identified" cover crop. The balansa clover is commercially available from Australia and more extensive field trials are planned.

Mowing was very effective in killing rye and vetch during late April after rye shed pollen. Mow killing caused rapid desiccation of cover crop residues and, together with the use of tined-wheel row cleaners, allowed the interval between killing a cover crop and no-till

cotton planting to be as short as one to six days. This short interval allows for timely cotton planting and maximizes the weed control benefits from the cover crop mulch. Planting into rye residues mowed less than seven days earlier was unsatisfactory where row cleaners were not used. The Martin Row Cleaner® and the Yetter Residue Manager® had the less tendency to plug with residues than the Acraplant Zone Manager® and caused less hair-pinning of residues than standard ripple coulters.

Cover crop mulches stabilized soil temperature, resulting in warmer minimum and cooler maximum temperatures, and increased early cotton growth rates. Soil temperatures were not higher under a dark-colored vetch mulch than under a light-colored rye mulch. Rye provided the greatest degree of weed suppression, whereas hairy vetch seemed to enhance growth of grass weeds, possibly because of increased available nitrogen. Although even rye did not eliminate the need for supplemental weed control, cover crops permitted no-till cotton to be produced with no more herbicides than are used in conventional tillage culture. In 1994, a rye plus vetch cover crop increased cotton yields enough to pay for planting the cover crop.

Observations and Plans

Dry soil conditions and little expected rainfall justify early killing of cover crops. At Jim Whitfield's farm, dry soil slowed cotton growth where cover crops were mow-killed two days before planting compared to earlier spray-killed or disk-killed areas. Flail mowing heavy cover crops proved to be a slow process in two on-farm trials (a mower drive belt was burned up in Tennessee); a disk mower will be evaluated as a more rapid alternative next year. Early maturity of cotton is needed to allow timely planting of cover crops; to avoid this problem, future research will test starch polymer seed treatments as a way of improving the reliability of broadcast seeding cover crops at the time of cotton defoliation.

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LS94-57

Disease and Insect Management Using New Crop Rotations for Sustainable Production of Row Crops in the Southeastern United States

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Abstract

Planting two crops in one year with minimum tillage in the southeastern U.S. during the past 20 years has often resulted in reduced crop rotation because a limited number of crops fit into the system. The wheat\soybean double cropping system was one of the most commonly used combinations. Continuous planting of this cropping sequence resulted in epidemics of take-all root rot of wheat, a disease previously unimportant in the region. New races of Hessian fly appeared that caused severe losses on susceptible wheat cultivars. Soybean stem canker also was epidemic.

Lack of profitability has caused the farmer-cooperator in the study to reduce soybean and corn production during the past five years and rely on shorter, more profitable rotations primarily with full-season wheat and peanuts. We propose to compare rotational sequences which incorporate additional new crops into the minimum tillage system with wheat and soybean to reduce pests on all crops through longer rotations.

Canola is an emerging crop which can be substituted for wheat or other small grains. A new cultivar of pearl millet is a potential summer rotational crop that can replace soybean in the minimum tillage system. This expanded system can increase the profitability of all crops and reduce pesticide use while maintaining soil and water quality.

Pathogen and pest populations and crop damage will be monitored in replicated trials on a research farm and in demonstrations on a commercial farm and a regional farm exposition site. Nine combinations of treatments will provide information on the optimum cropping sequences and number of years needed between crops to manage diseases and insect pests. The rotations investigated in the study can also be integrated into cropping sequences utilizing full season crops such as peanuts, cotton, and corn. Results will be disseminated by field demonstrations, preparation of video documentary, and via regional and national popular and scientific publications.

Objectives

1.) To enhance double cropping systems with minimum tillage in the southeastern U.S. by expanding crop rotations which can be profitable and which can reduce diseases and insects.

2.) To incorporate improved cultivars of emerging crops canola and grain pearl millet into minimum tillage systems.

3.) To determine the optimal rotation system to manage diseases and insects in canola, pearl millet, soybeans, and wheat.

4.) To demonstrate the usefulness of these rotations to growers on a commercial farm and at a major regional farm exposition site.

Project area
Integrated Management

Project duration
July 1994-July 1997

Budget:

SARE/ACE	$152,200
Matching	$52,614

SARE/ACE
Sustainable Agriculture Research and Education
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Post-CRP Land Management and Sustainable Production Alternatives for Highly Erodible Lands in the Southern Great Plains

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Abstract

A deficiency of integrated research and education information on conservation management of highly erodible lands (HEL) retired under the Conservation Reserve program (CRP) of the 1985 Food Security Act exists in the southern Great Plains. Oklahoma has 1.2 million acres enrolled in CRP. Much of this land was cropped annually to winter wheat. Dryland cotton production is also important in SW Oklahoma. Soil erosion and associated particulate nutrient discharges are significant problems in the production of both of these crops. Old World bluestem and native grasses have been extensively used for permanent soil cover.

A collaborative study was conceived to determine the persistence of improvements to the soil resource base accumulated during CRP tenure for subhumid/semiarid climate under alternate land management practices. Replicated farm-scale fields will be established on existing CRP lands at two locations in western Oklahoma to study (i) grass cover improvement practices and (ii) evaluate conventional and conservation production systems for the transition back to winter wheat (*Triticum aestivum L.*) and cotton (*Gossypium hirsutum L.*) production. The study will also serve as a demonstration of conservation production and nonpoint source pollution prevention practices. System performance, crop yield, and alternations in indices of soil quality will be measured. The goals are to document the sustainability and environmental impacts of the management options while generating inputs for guiding development of future conservation policies.

Educational activities will be organized by action agencies and producer cooperators to promote technology adoption and address similar situations facing contract holders across Oklahoma and the southern region.

Objectives

1.) Determine relative persistence of improvements to the soil resource base accumulated during the Conservation Reserve program under alternate land management practices.

2.) Identify best-management options and develop guidelines for environmentally sound cropping-livestock systems of production that will preserve and sustain the accumulated benefits to the soil resource base.

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Project area
Management system

Project duration
July 1994-1997

Budget:

SARE/ACE	$196,100
Matching	$90,000

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
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Annual Report
LS94-59
AS94-13

Assessing the Impact of Beneficial Insect Populations on Organic Farms

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Abstract

Organic growers depend upon beneficial insects to control pest species. Little is known about the impact of naturally-occurring beneficial species or the need for supplemental releases. The project proposed herein has as its objectives to:

1.) Identify species of natural enemies present in organically-grown tomatoes.

2.) Characterize the seasonal patterns of abundance for important natural enemy species.

3.) Identify the important prey or host species for these natural enemies.

4.) Document the impact of naturally-occurring biological control on populations of key pest species.

5.) Measure the impact of releases of commercially purchased lacewings and *Trichogramma*.

All field work in this project will be conducted on four commercial organic farms in three agriculturally distinct areas of North Carolina. Pest and natural enemy populations will be monitored at least weekly at each location. The impact of naturally-occurring parasitoids and predators on pest populations will be assessed through natural enemy exclusion studies.

Commercially purchased green lacewings and *Trichogramma* will be released at two of the study sites. Their effects on aphid populations, on tomato fruitworm egg survival, and on the incidence of fruitworm damaged fruits will be assessed.

This project has general relevance to the Southern Region because it will provide the only thorough documentation of the impact of naturally-occurring biological control and of natural enemy releases on populations of key insect pests and on the incidence of pest damaged produce in commercial organic vegetable production available for organic farms in the region.

Because the impact of biological control is likely to be less under conventional and perhaps sustainable farming practices, this project will help to identify the level of biological control that can be obtained when production practices are modified to accommodate the important biocontrol agents. We view this project as providing the baseline information needed to design more efficient and more geographically inclusive research to assess the economic benefits of natural enemy releases. Clear documentation of such benefits would help not only farmers, but also the developing commercial insectary business.

Objectives

1.) Identify species of natural enemies present in organically-grown tomatoes.

2.) Characterize the seasonal patterns of abundance for important natural enemy species.

3.) Identify the important prey or host species for these natural enemies.

4.) Document the impact of naturally-occurring biological control on populations of key pest species.

5.) Measure the impact of releases of commercially purchased lacewings and *Trichogramma*.

Project area

Beneficial insects

Project duration

Sept. 1994-Sept. 1996

Budget:

SARE	$17,735
ACE	$37,207
Matching	$14,068

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LS94-60

Integration of Animal Waste, Winter Cover Crops, and Biological Antagonists for Sustained Management of Columbia Lance and Other Associated Nematodes on Cotton

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Abstract

This research-extension project focuses on conversion of animal manure from a waste product to a renewable natural resource and soil conservation practices which will enhance cotton productivity through improved nematode management. Animal manure can serve to replace costly inputs of chemical pesticides and fertilizers, resulting in a more sustainable means of cotton and associated crop production.

The goal of this proposed work is to develop an integrated and sustainable nematode-management and cotton production system, based on environmentally acceptable use of animal and municipal waste, soil conservation practices, and biological control.

The project includes faculty from plant pathology, soil science, crop science, economics and USDA; county extension staff; and cotton growers. Interdisciplinary research will include: greenhouse, microplot, grower-field experiments and demonstration plots for outreach. On-farm research and demonstration sites will serve as focal points for County tours and sites for Extension Agent training in Sustainable Agriculture. Expected benefits from this program include:

1.) reduced reliance on chemical pesticides and fertilizers 2.) improved water quality and soil conservation; 3.) increased cotton profitability through enhanced nematode management; and 4.) provide an additional beneficial use for organic wastes.

Objectives

1.) Evaluate the effects of the rate of chicken manure and litter, and municipal waste compost singly and in combination with winter-cover crops and selected nematode antagonists for control of plant-parasitic nematodes on cotton.

2.) Determine the potential advantages of organic sources of nitrogen versus standard fertilizers on nitrogen use efficiency and potential environmental impacts.

3.) Incorporate findings into a sustainable cotton and associated crop-production systems through a series of farmer-managed demonstration tests, tours, cotton-production meetings, and extension publications.

Project area

Biological pest control

Project duration

Sept.1994-Sept.1997

Budget:

SARE/ACE	$ 46,721
Matching	$ 12,356

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Integrating Sustainable Forestry into the Whole Farm Management of Minority and Limited Resource Landowners in Two Regions of Arkansas

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Abstract

Limited resource and minority-owned farms have seen diminished returns. As a result, outmigration is eroding rural communities in the Arkansas counties of the Mississippi River Delta and the Ozarks. While woodlands are a potentially important source of farm income in these areas, hardwood-dominant woodlands tend to be found on frequently flooded lowlands or highly erodible slopes. Integrating multiple-use sustainable woodland management into their diversified farming systems will improve the social, economic and environmental sustainability of the whole farm. However, limited resource and minority farmers have not participated widely in traditional outreach programs.

The proposed project will compare community-based participatory strategies to encourage limited resource and minority farmers to integrate sustainable woodland management into their whole farm system.

With their farmer participates, Arkansas Land and Farm Development Corporation, a membership organization that serves minority and limited resource farmers in the Delta, and Ozark Foothills Resource Conservation and Development Council will develop locally-appropriate activities, which may include farmer networks, a landowner association, workshops, field days and other training activities, a demonstration of sustainable hardwood management and agroforestry, small-scale nontimber enterprises, and a newsletter.

Winrock will provide economic analysis for timber and nontimber income generating activities, and prepare a comparative case study.

The Nature Conservancy will provide environmental analysis of project activities. Together, farmer and organizational participants will evaluate the impact of government policies and programs on limited resources and minority farmers' hardwood management decisions, and produce a public policy paper with recommendations.

Participants and other invited institutional partners will produce a series of highly visual fact sheets aimed at limited resource and minority farmers, which will be assembled in locally appropriate handbooks. An evaluation and dissemination plan is included in this proposal.

Objectives

1.) Test context-appropriate participatory strategies to promote sustainable farm forestry for the Delta and the Ozarks.

2.) Compare contexts and strategies to identify factors that influence effectiveness.

3.) Engage limited resource and minority farmers, community-based organizations, technical advisors and policy-makers in a dialogue about how best to effectively promote sustainable management of hardwoods on the farm.

4.) Evaluate existing policies and programs.

Project area

Integrated systems

Project duration

July 1994-July 1997

Budget:

SARE/ACE	$246,710
Matching	$159,086

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Sustainable Agriculture Research and Education
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Intercropping Small Grains and Lupin for Sustainable On-Farm Utilization

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Abstract

Intercropping cereals and legumes has been shown to have many important agronomic benefits. Cereal-legume mixtures may be of special interest to southern dairy producers because feed costs are the most important variable for the profitability of dairy operations. Producing a larger proportion of the ration on-farm at a reasonable cost will likely enhance sustainability of dairy operations in the South.

It is the goal of this research to develop high quality small grain-lupin forage and/or grain mixtures. Wheat/oat-lupin intercrops will be tested and compared to controls for three years in on-farm trials at 14 location x year combinations.

Three seeding rates of small grain will be combined factorially with three seeding rates of two sweet white lupin cultivars. These two cultivars differ in genetic background and time of maturity. Controls are monocropped small grain, a small grain-hairy vetch mixture and the two lupin cultivars monocropped at an intermediate seeding rate.

Agronomic characteristics studied will be stand performance over time, yield of the mixture and individual components both for silage and grain. Forage quality of fresh and ensiled material will be evaluated at one site per year within each of the three participating states.

Data obtained will be subjected to statistical procedures to evaluate the stability of treatments across sites. Economic risk and return analyses will also be performed. Producer involvement in decision-making and conduct of trials will lead to a direct farmer-to-farmer technology transfer through exchange of information at the farmer level. Field days will be conducted each year to disseminate production, quality and economic information gained from this project.

Objectives

1.) Develop a small grain-lupin intercropping systems for silage\grain production which will offer a more profitable and sustainable feed source for livestock enterprises, particularly dairy operations.

2.) Evaluate the stability of the grain-lupin intercropping system across the region.

3.) Utilize, yield, quality and price data to develop economic enterprise analyses for lupin-based production systems.

Project area
Intercropping

Project duration
July 1994-July 1997

Budget:

SARE/ACE	$143,151
Matching	$164,759

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Regional Center for Sustainable Dairy Farming

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Project area
Integrated systems

Project duration
April 1994-April 1997

Budget:

SARE/ACE	$180,497
Matching	$127,924

Abstract

Dairy farm numbers in the Carolinas and Virginia have declined by one-third during the last decade. We propose to establish a Regional Center for Sustainable Dairy Farming to evaluate and demonstrate profitable integrated systems of crop and dairy production. The primary objective is to evaluate the profitability of two such systems: one based on intensively managed pasture crops, the other based on row crops and conventional confinement housing and feeding. Water quality, manure management, and seasonal production of milk will also be addressed.

The proposed Center is the most effective way to answer questions about promising alternative dairy production systems and their environmental impacts. The dairy research farm at NCSU is suitable because it has approximately 140 cows and the soil types and farm layout are suited to the production of a variety of forage types. Data collection and analysis will permit a comprehensive evaluation of economic and environmental impacts of these alternative systems of dairying. This project would complement the existing SARE project on Trantham's Dairy Farm in South Carolina and the Long Creek Watershed project in Gaston County, North Carolina.

The proposed Center will be guided by an advisory committee drawn from farmers and extension personnel from three states, with interdisciplinary involvement of faculty from Virginia Tech, Clemson, North Carolina A&T State, and North Carolina State universities. Educational outreach based on research at the Center would provide profitable survival strategies for family dairy farms in the region.

Objectives

1.) Compare and evaluate profitability of two integrated systems of dairy production; one based on intensively managed pasture crops, the other based on row crops and conventional confinement housing and feeding.

2.) Evaluate the impact of the pasture-based system on animal performance and health compared to the conventional confinement system.

3.) Examine the feasibility of seasonal milk production within the pasture-based and conventional confinement systems.

4.) Evaluate nonpoint source water quality and soil conservation impacts of land uses under the pasture-based and row crop forage systems.

5.) Demonstrate and disseminate the results among farmers, extension personnel, service industry personnel, students, and others.

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LS91-40.1
LS94.40.1

Utilization of Winter Legume Cover Crops for Pest and Fertility Management in Cotton

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Objectives

The general concern with winter cover crops has involved a perception that pest problems in the summer crop would increase due to the cover crop, in particular legume cover crops. On the other hand, cover crops or attractive field borders may enhance the number and diversity of natural enemies reducing pest problems. Seven sites examined the benefits and risks from pests as a result of the use of winter legume cover crops in cotton production systems.

Approach

The two long-term sites were Clarkedale, Arkansas, established in 1972, and Bossier City, Louisiana, established in 1955. All sites had the cover crop treatments hairy vetch and winter fallow. Tillage comparisons, conservation and conventional, were included at four sites. The entomology sites, Edisto and Foreman, included two hairy vetch treatments; 1) all cover crop incorporated, and 2) strips of hairy vetch allowed to mature.

Results

The data indicate that cover crops are generally pest neutral for insects, weeds, soilborne plant pathogens, and nematodes. The hairy vetch cover crop reduced populations of *Thielaviopsis basicola,* the causal agent of black root rot, compared to the winter fallow treatment.

Data also suggested that maintaining strips of hairy vetch in the cotton crop are serving as a trap crop for thrips. The root knot nematode, *Meloidogyne incognita*, increased by the use of legume cover crops in 1992, but this response was not consistent over years.

These data are quite encouraging for the use of cover crops in commercial cotton production systems. Additional research is needed to quantify *Meloidogyne incognita* damage and develop management solutions, including timing of incorporation of the cover crop or identifying resistant legume cover crop species.

Improved soil and plant nitrogen status was detected from the use of a legume cover crop. The economic analyses of the sites indicate that the use of a hairy vetch winter cover crop under conventional tillage resulted in higher net returns than traditional winter fallow at five sites.

In addition, cotton production under conventional tillage was more profitable than the reduced tillage practices employed at two of the sites in this study. Cotton using winter fallow in combination with reduced tillage was more profitable than cotton production with hairy vetch-reduced tillage. This research has established that an environmental sound production system does not appear to increase pest problems and is economically sound.

Project area
Cover crops

Project duration
October 1991-Dec. 1994

Budget:

SARE/ACE	$304,000
Matching	$420,255

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Annual Report
AS92-1

An Integrated Technological and Marketing Strategy to Make Broiler Production More Sustainable

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Cooperators continued on next page

Project area
Waste management

Project duration
Feb. 1992 - Feb. 1995

Budget:

SARE/ACE	$200,000
Matching	$101,409

Objectives

The goal of this integrated education, research, and demonstration project has been to increase utilization of poultry litter in ways that increase its economic value and protect surface and ground water. Projective objectives:

1.) Identify and demonstrate economically and environmentally sound on- and off-farm litter and nutrient management practices that produce a consistent-quality litter for sale.

2.) Establish a more formal market for broiler litter in order to (a) make it easier for growers and contractors who clean broiler and turkey houses to find buyers, (b) increase the price of litter to its real economic value as a source of nutrients and organic matter for plant and animal production, (c) get more environmentally sustainable distribution of litter, and (d) provide, when necessary, a price incentive to encourage more wise storage and application of litter and improve farm profitability.

3.) Improve poultry producers', clean-out contractors', litter processors', and end users' knowledge of the interrelationships between production, processing, marketing, and utilization of litter, its nutrient content, its value, and its proper handling.

Approach and Results

Analyze existing informal marketing practices. Winrock and project cooperators have conducted case study analyses of existing marketing practices through interviews with growers, integrators, clean-out contractors, row crop farmers, ranchers, extension agents and specialists, NRCS (previously SCS) field staff, conservation district technicians and others. This work established a baseline of how the existing, informal poultry litter marketing system works.

Develop strategies to reduce variability of litter. To determine potential for fractionation technologies being developed by the University of Georgia (Ndegwa, et al, 1991) to separate "fines" for sale to a producer of bagged potting soil and the "coarse" fraction for reuse as bedding in the poultry house, University of Arkansas and Oklahoma State University faculty analyzed chemical and structural variability of litter removed from broiler houses at different locations in the house and following each of six flocks. The project has also evaluated how companies that are producing a "processed" litter control variability.

Encourage growers to invest in litter storage facilities. To increase flexibility in when litter can be sold, purchased, delivered and used, project staff and cooperators have evaluated methods of storing litter in cost effective and environmentally safe ways.

Bring buyers and sellers together. To facilitate contact between potential buyers and sellers of litter, Winrock established a 1-800 "poultry litter marketing" telephone hotline, and developed informational and educational materials to tell farmers about the hotline and its use.

Improve buyers' and sellers' knowledge of litter prices. Winrock and the Arkansas Cooperative Extension Service have used data from the 1-800 hotline and other sources to track prices paid by farmers for litter. Winrock and project cooperators have shared this information through publications and individual consultations.

Identify and develop educational programs for clean-out contractors. Winrock staff and project cooperators have identified clean-out contractors who are active in Arkansas and Oklahoma. Those that indicated a particular interest in selling litter outside the area where it was produced have been sent educational materials on handling and marketing of litter throughout the project.

Identify, evaluate, and arrange least-cost transportation of litter. Winrock staff and project cooperators have evaluated various methods available to transport litter from western Arkansas to eastern Arkansas. Particular emphasis has been placed on determining the opportunities for back hauls by trucks, railroads, and barges currently traveling empty from poultry production areas to areas where litter can be productively uses.

Recommend strategies to increase demand for litter. Winrock staff and project coopera-

tors have explored opportunities for increasing use of poultry litter as a cattle feed, particularly for use in feedlots, and as a means of restoring productivity to soils damaged in various ways. Particular attention has been paid to the marketing efforts and problems of firms that are processing litter into higher value products.

Impact

This project has expanded knowledge base of how litter was being handled in the state. As assumed in the original proposal, we found that farmers and others are very innovative in the ways they use litter. People with concerns about the economic or environmental well being of the state have used the new knowledge generated by this project and been given opportunities to work and learn together for the common goal of sustainable poultry production that is environmentally sound, economically viable, and socially acceptable).

Many poultry farmers now have an opportunity to sell their litter at a fair price, while reducing a threat to water quality on their farm or in their communities. Some poultry farmers have been able to sell litter for the first time because of this project. Previously they were giving it away to simply get it off the farm.

Crop farmers that have seen the productivity of their land reduced because of precision leveling or because of other soil problems now have an opportunity to purchase poultry litter at a fair price and restore productivity. While there is no way to precisely determine how much litter this project has helped move from western Arkansas where it can cause water quality degradation to areas where it can be productively used, project staff and cooperators believe that a conservative estimate is that 150,000 tons were marketed as a result of this project in 1994. Working in cooperation with the Central Arkansas Resource Conservation and Development Council, the project has helped purchase five litter spreaders and locate them in counties where a demand for litter has been observed, but no equipment was available to farmers to spread the litter.

Marketing strategies to link poultry litter buyers and sellers together have been developed and seem to be sustainable. Independent business men and women have started firms to market poultry litter as either a raw or processed product.

This project was the first to report that about 70 percent of the poultry farmers were hiring clean-out contractors to remove litter from their broiler and turkey houses. In many ways these businessmen determine whether poultry litter is properly or improperly applied on farmers fields. Previous to this project all best management practices, regulation, educational programs, and financial incentives to encourage proper management of litter have been directed to farmers. As a result of this project educational materials are being prepared for clean-out contractors and educational programs for these individuals will be offered by the Cooperative Extension Services in Arkansas and Oklahoma.

Truckers, including farmers and cleanout contractors with trucks, can now haul bedding and litter in the same truck trailer as long as the trailer is cleaned after hauling litter. This has helped reduce the cost of handling litter and made it a more marketable product. Several "litter brokers" have made it possible for independent truck owners and operators to obtain loads when they return from western Arkansas to eastern Arkansas. This allows them to at least cover the cost of returning to their home base.

The project has encouraged new ideas to be tested, some of which have provided new ways to handle and use poultry litter in environmentally sound, economically viable, and socially acceptable ways.

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Habitat Enhancement for Beneficial Insects in Vegetable and Fruit Farming Systems

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Development Corporation

Objectives

Many species of predatory and parasitic arthropods exist, including ladybugs, lacewings, parasitic wasps and flies, minute pirate bugs, big-eyed bugs, and spiders. Often referred to as "beneficials", they can play and important role in reducing numbers of insect pests. However, in order for these natural enemies of insect pests to survive and multiply, they need nectar and pollen, alternate prey, water, shelter from wind and rain, and overwintering sites. Some of these habitat needs can be met by increasing plant species diversity in our agricultural production systems.

Which plant species are most attractive to "beneficial" insects? Can we design diversified planting systems that will reduce pest damage to vegetable crops? Can these systems be profitable and practical to manage?

These questions were the basis for work begun in 1992 on farms of 10 vegetable growers in Arkansas and Oklahoma, and at Oklahoma State University, Arkansas State University, and Auburn University research stations. Two of the Arkansas farms belong to and provide educational demonstrations for non-profit organizations. The other 8 farms range in size from 12 acres to 220 acres, with 1/2 to 4 acres used for vegetable production. All grow a diversity of vegetables, fruits, and flowers.

Approach

To answer the first question, participants observed insect activity on plots of wildflowers, herbs, and legumes. Plants noted by many farmers as being highly attractive to beneficial insects include basil, cilantro, dill (and all flowering plants in the umbel family), yarrow, buckwheat, and crimson clover. Other flowers noted by 1-2 farmers as highly attractive were anise hyssop, garlic chives, mints, goldenrod and other native plants in the composite family, and a commercial mix sold as Good Bug Blend.

To answer the second and third questions, farmers and researchers compared cabbage grown with companion plants to cabbage grown without companion plants. Based on their experience and observations, farmers evaluated several strategies for incorporating "habitat enhancing" plants into cropping systems.

Companion planting - a mix of different species of plants within a row or bed - was rated as difficult to manage due to varying cultural needs of species i.e. planting time, harvest time and methods of planting and harvesting.

Strip planting - alternate rows or beds of "habitat" plants and vegetables - were rated as most easily adapted to vegetable production systems. One grower planted strips 4' - 8' wide alternately with strips of vegetables about 25' wide. Another grew vegetables in beds 65' X 4' with every 6th bed planted to perennial or self-seeding wildflowers or herbs. Growers and researchers saw additional benefits to planting vegetables in strips mowed or tilled through winter cover crops (clovers, vetches, alfalfa, oats, rye . . .) In addition to habitat for insects, the cover crop residue provides weed suppressing mulch, organic matter, nutrients, and erosion prevention.

Border plantings - fence rows, field edges, or islands of "habitat" plants - was also rated as reasonably adaptable.

In all systems, cooperators agreed that diversity is desirable. Bloom period can be extended with a variety of species. Cooperators also agreed that habitat plants should have additional value to the farmer as cut flowers, herbs, green manures, or forages. For example, dried yarrow flowers can add value to garlic braids; cover crops improve the soil; the beauty of flowers in the garden adds pleasure for PYO customers. "Ambience is very important on our farm," commented one project farmer.

The value of the project is indicated by statements made by participating farmers:

"I always wanted to plant more winter cover crops. I did so this winter for the project - now I will keep on doing it."

"From now on, we will plan our plantings so that we always have members of the umbel family (dill, cilantro, parsley, carrots, fennel) in bloom throughout the growing season."

In regard to a non-cultivated area containing vetch, various grasses, black-eyed Susan, lambs quarter, gaillardia, lemon mint, dill, crimson, clover, and buckwheat, "One can hardly object to a field of such plants . . . Indeed, they are a joy, they came up this year by themselves, and to an important degree, they

Project area
Beneficial insects

Project duration
February 92 - January 95

Budget:

SARE/ACE	$200,000
Matching	$79,975

replace other less desirable plants. This area at my place is 'crawling with insects', in contrast to my clean-till plot."

Farmers cited interaction with other farmers, learning new things, and contributing to knowledge about sustainable agriculture as important benefits from their involvement with this project. They are sharing what they learned with other farmers and with their customers on a daily basis. A "case studies" book detailing the operations of project farmers is planned.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Final Report
AS92-3

Integration of Natural Enemies for Management of the Sweet Potato Whitefly and Associated Disorders on Mixed-cropped Vegetables

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Cooperators continued on next page

Project area
IPM

Project duration
October 1992-October 1994

Budget:
SARE/ACE $170,000
Matching $77,789

Objectives

1.) Evaluate intercropping marketable crops for the manipulation of sweetpotato whitefly (SPWF) populations and the viruses they vector in Florida and Texas.

2.) Estimate the profitability of the methods employed to manage the SPWF on vegetables.

3.) Disseminate information to growers and extension personnel throughout the Southern Region.

Approach

One site in southwest Florida and 19 sites in three geographic areas in Texas were sampled periodically for the presence of the SPWF and its natural enemies, principally small wasp parasites. The sites were primarily organic mixed-crop vegetable operations although some of the sites in Texas were nursery operations and ornamental plantings that were not sprayed with conventional insecticides.

Although damaging levels of some pests such as spider mites, pepper weevils, potato aphids, and certain plant diseases caused by fungi were observed at the Florida vegetable organic farm, populations of the SPWF did not increase to damaging levels. Incidence of tomato mottle geminivirus (TMoV), a plant virus vectored by the SPWF, was low in the first year of study but reached nearly 100% of the tomato plants infected in the second year. This occurred because the grower located new plantings of tomato adjacent to older, infected plantings. Whiteflies appeared to migrate into the crops in the fall and reach their highest levels early in the season. However, increasing activity of parasitic wasps such as *Encarsia pergandiella* corresponded to decreasing SPWF populations.

A mathematical model to describe the development and movement of SPWF populations in a small mixed-cropped vegetable farm is under development and will be used as a basis for developing a similar model describing SPWF populations in a mixed-crop region such as south Texas or southern California. These models will help in our understanding of potential and real effects of cropping arrangements and sequences on SPWF population development and movement and will be helpful in developing regional and local SPWF management strategies.

In Texas, a situation similar to that in Florida occurred. The SPWF proved nearly inconsequential on organic farms that were located away from the conventional farming system in south Texas. In fact, the SPWF could not be found on some organic farms; in most cases SPWF populations were so small that host plants required intensive sampling to find specimens. Organic farms located in the conventional farming areas were found to suffer damage from the SPWF which migrated from adjacent crops.

Refuges of sunflower and kale were initiated as companion plantings of watermelon with the cooperating organic farm in the Rio Grande Valley. Adult SPWF migrating from cotton overwhelmed the refuges and melons. Delaying mid-season and fall plantings until after flights of SPWF from early melons and cotton have occurred is becoming more widely accepted. Alternative planting times and refuge plantings to conserve the SPWF and its natural enemies are now recognized as a possible means to overcome this recurrent problem.

Even though natural enemies can control the SPWF, the realization of their potential in heavily sprayed conventional farms is difficult. Efforts have been undertaken to enhance the levels of biological control either directly or by reducing initial SPWF populations. Squash and other cucurbits were evaluated as companion and trap crops for tomato for reducing SPWF populations and TMoV incidence. In laboratory and greenhouse experiments, squash was at least twice as attractive than tomato to SPWF adults. In a replicated small plot experiment, tomato was planted either alone or adjacent to squash or mixed cucurbit crops. Although the numbers of SPWF adults and nymphs were not consistently affected on the tomato in companion plantings compared to the tomato planted alone, the incidence of TMoV was less in com-

panion-planted tomato. In one large plot experiment in conventional tomato fields, tomato growing adjacent to six row plantings of squash had fewer SPWF adults and less incidence of TMoV than tomato growing adjacent to tomato; however, in another similar experiment, the reverse was true. Nevertheless, one of the cooperating growers will include a 5 acre planting of squash in the spring crop to further evaluate squash as a trap for migrating SPWF adults.

In replicated small plot experiments, tomato plants growing on UV-reflective plastic soil mulch had fewer SPWF adults and less incidence of TMoV than tomato plants growing on white plastic. Similar results with SPWF adults were obtained in a demonstration on three conventional tomato farms. Incidence of TMoV was low so no difference in yield between plants growing on UV-reflective mulch and plants growing on white mulch was observed.

The insect- pathogenic fungus, *Paecilomyces fumosoroseus*, was applied to individual plants in a flowering tomato crop. The fungus was recovered up to seven weeks later and peaked three weeks after application when 32% of the whitefly nymphs were infected. A similar application on squash was less effective, presumably because of lower humidity within the plant canopy.

A combination of whey, yeast and sucrose was applied weekly to tomato plants in the field to attract predator insects. The sprays mimicked the sugary honeydew secreted by feeding whiteflies and resulted in increased oviposition by lacewings compared to nonsprayed tomato plants. Similar applications on squash were ineffective, probably because of the large amount of honeydew already deposited by large numbers of SPWF present.

Detailed economic analyses to estimate the profitability of the investigated methods for SPWF management have not been completed; however, a preliminary first year comparison of the organic farm site in Florida with a hypothetical conventional farm was completed. Only items that highlight the cost differences between the farming operations were included.

The results suggest that the organic grower invested more than twice as much for producing and applying compost for fertilization but invested $400 less per acre for pest control. Pest control expenses for the organic grower increased in the second year because of increased pest problems and a resulting greater reliance on organically approved pesticides.

An on-farm field day was held at the organic farm site in Florida. The field day was attended by 35 people consisting of conventional farmers, organic farmers, chemical industry representatives, people interested in organic farming, and University of Florida extension and research personnel.

The cooperating organic farmer shared his philosophy and methodology for growing vegetables in a question and answer format. A broad overview of the SARE project was summarized in formal presentations, handouts, and a poster followed by a tour of the farm.

Summaries of the findings and recommendations from these studies have been presented at numerous local and statewide conferences, seminars, and organic and conventional grower meetings. Training in sampling methods and identification of the parasites associated with the SPWF in south Texas has been conducted. Certain of the results and recommendations of the project have been published in proceedings of statewide grower meetings and in the Proceedings of the Second Conference of Environmentally Sound Agriculture.

Cooperators continued

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SARE/ACE
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Agriculture in Concert with the Environment
Southern Region

Annual Report
AS 92-4

CROPS, the Crop Rotation Planning System for Whole-Farm Environmental and Economic Planning

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Project area
Systems planning

Project duration
October 1992-January 1995

Budget:
SARE/ACE $140,000
Matching $88,247

Objectives

1.) Implement and evaluate a whole farm planning system (CROPS) to assist farmers in developing crop rotation plans, adopting environmentally sound practices, and complying with state and federal land-use regulations

2.) Expand the livestock component of the CROPS system to include manure management.

3.) Improve the economic evaluation component of CROPS by establishing data and file-transfer linkages with the PLANETOR program.

4.) Modify CROPS for vegetable production systems and test it on a small scale vegetable farm.

Abstract

CROPS is a computer program for whole-farm planning. It recommends crop rotation, tillage and management scenarios for all fields on a farm that together meet the needs of the producer while also addressing environmental considerations. The program has been extensively redesigned internally over the last two years to include more livestock and nutrient management, farm program production constraints, enduring erosion control and management practices, vegetable production, and to enable results to be presented as a comparison with current practices. We have established feasibility studies with both the Soil Conservation Service and Virginia's Division of Soil and Water Conservation to determine whether the system meets their needs as a planning tool. The project has also been delayed in its field evaluation with farmers due to unexpected programming problems. Nevertheless, we expect to complete the project within the next six months.

Results

This project began with a computer program called CROPS that could be used by farmers to develop whole-farm plans that consider a set of multiple and perhaps conflicting objectives. Our goal for this project was to improve that program so that it could be delivered to farmers, tested on the farm, and improved to be more generally applicable to different farming types. In addition, we felt it was necessary to make the system compatible with another farm-level decision aid, PLANETOR, being developed with funding from the SARE/ACE program so that these two efforts could work synergistically.

This year we widely tested and modified a manure management subprogram that inventories and helps allocate animal manures as fertilizer through a multi-year farm plan. We have also added several practices relating to soil conservation that were not originally part of the system (enduring or engineered practices like waterways) to gain acceptance and compatibility with the planning process of the soil conservation service.

Objective # 1 Our efforts this year have focused on generating plans that comply with state and federal land-use regualtions and guidelines. Specifically, we met once every two months with representatives from the Soil Conservation Service and Virginia's Division of Soil and Water Conservation. We have identified a set of enduring management practices that the system needs to include (e.g., grass waterways, fencing, and other engineered practices) to meet the needs of the Soil Conservation Service planning methodology. We compiled economic budgets for these practices and conducted several knowledge engineering sessions with SCS district conservationists in Harrisonburg, Virginia, to determine appropriate application rules.

We have adopted a new model of assessing CROPS-generated plans as well: comparison to a benchmark plan that represents current practices. This requires the farmer/user to enter the current cropping plan for each field of the farm at the time of field inventory. Subsequent analyses including economic and environmental comparisons, are now based on a comparison to the benchmark, and where appropriate, a direct estimate of risk.

Finally, we developed a module addressing farm program participation constraints and allowing for the automatic generation of optimal crop production targets based on different farm

program participation options and feed requirements. This module uses a linear programming solver to find optimal crop targets that can then be used by the farmer in further planning. The optimal solution does not consider all the environmental or practical constraints on production, and is meant only to help the farmer determine appropriate targets for the full planner to pursue.

The pace of implementation of the project has been slower then anticipate due to changes in programming environments, coordination with another evolving software project, PLANETOR, and by personnel changes. Field evaluation of the full system has therefore been delayed.

Objective # 2 Algorithms developed last year in cooperation with Virginia's nutrient management specialists were tested and evaluated by ten Nutrient Management Specialists statewide. These algorighms include inventory of animal manure production, storage, and nutrient content, field manure level constraints based on field characteristics, environmental hazards, and crop nutrient needs. Continued modification of these algorithms have been conducted based on comments from the specialists.

Objective #3 A new version of the PLANETOR program was released this fall, and we are currently trying to get get copies and training for Dr. Pease so that we can modify our linkage design appropriately.

Objective #4 Planning for vegetable production has proven more complicated than anticipated. The overriding problem is that for our small-scale cooperator, crop production levels for specific vegetables and varieties cannot be set until very close to planting times. Short term market demands drive this final decision. Our focus, therefore, has been this year to modify our planning engine to allow for planning at different levels of abstraction: a crop rotation plan for vegetable production at the family level, for example, could be filled in later with specific vegetables.

Our previous attempt at using an optimizing planner did not answer the need for flexibility in the plans produced, but it might be useful in the final, most detailed, planning stage in this new scheme. In the next six months, we hope to implement a hierarchical planner into the CROPS sytsem, but this is requiring much more basic research into planning methodologies than anticipated and might require more time to complete.

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Southern Region

Annual Report
AS92-5

Effects of Sustainable and Conventional Agriculture on Farm Wildlife

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Objectives

Northern bobwhite quail numbers have been declining in the southern United States since the 1970s. Pesticides, predators, habitat modification and hunting have all been listed as factors contributing to decreased quail numbers. Accordingly, a multi-disciplinary SARE/ACE study was initiated in 1992 to determine if the implementation of sustainable agricultural crop production systems, with their emphases upon reduced pesticide use, could reverse the quail decline.

Specific objectives for the project included:

1.) Compare the effects of sustainable versus conventional crop management on the use of crop fields by bobwhite quail and other wildlife species.

2.) Determine the value of planted and non-planted habitats, such as field borders and ditch banks, as year-round habitat for quail and other wildlife species.

3.) Quantify direct and indirect effects of selected pesticides on bobwhite quail and other wildlife species.

4.) Compare the economic costs and benefits of wildlife habitat in sustainable versus conventional cropping environments.

5.) Utilize case studies of cooperating growers and a survey of landowners' attitudes on wildlife management to develop guidelines for persuading farmers and landowners' to adopt sustainable practices beneficial to wildlife.

6.) Offer viable suggestions for enhancing wildlife resources occupying the agricultural landscape without sacrificing farm profitability.

Approach

Efforts to elucidate the impact of farming operations on the bobwhite quail and other farm wildlife have involved a variety of innovative and unique techniques for measuring wildlife responses to agricultural activities. At the Alligator River National Wildlife Refuge (ARNWR), the behavior of wild quail equipped with miniature radio-transmitters was monitored from March until October. The study area was divided into 4 blocks about 500 acres in size. Two of the blocks were "clean-farmed" and two featured 15-foot field borders alongside numerous drainage ditches. A total of 347 quail were captured during 1993 and 1994. One hundred seventeen quail were transmittered in 1994; 74 were female. Total telemetry locations for 1993-1994 exceeded 5,000. To corroborate telemetry data, ditches were walked and flush counts recorded.

To determine the amount of insects needed for normal growth and feathering, a series of growth rate trials with quail chicks were conducted. Each quail chick was fed a specific amount of insect matter. Growth and feathering were recorded and a minimum daily insect requirement for quail chicks calculated. Project personnel also developed procedures for human imprinting of quail chicks. Human imprinted quail chicks proved to be a powerful tool for studying pesticide effects and the habitat values of crop and non-cropland areas.

Ninety-two feeding rate trials were conducted.

Results

Radio-telemetry measurements describing the behavior of transmittered bobwhite quail suggest that quail spend considerable time in and around crop fields. Accordingly, they may be exposed frequently to foliar insecticides. Controlled studies exposing quail to the high labelled rate of foliar insecticides (worst case scenario) used most often on soybeans and cotton produced no direct effects on the birds. In vivo habitat evaluation via measurement of the feeding rates of human-imprinted quail chicks ranked crop habitats in the following order: fallow fields > no-till drilled soybeans > conventional soybeans in rows > cotton fields > peanut fields. Over a two year period, agricultural areas with field borders produced 179 hatchlings as compared to 37 hatchlings in areas without field borders. Flush counts confirmed that cropped areas with field borders supported about 6 times more quail than areas without field borders. Other experiments confirmed that conservation tillage and remedial herbicide applications could increase the profitability of corn and soybeans in tidewater North Carolina. A machine designed to improve the vegetative structure on ditch banks and in field borders via the inexpensive (relative to mow-

Project area
Wildlife cropping system

Project duration
Feb. 1992 -Jan. 1995

Budget:

SARE/ACE	$130,000
Matching	$130,000

ing) "wiping" of those areas with glyphosate proved workable; it may allow growers to reduce the field maintenance costs while increasing the usefulness of field borders and ditches to wildlife, especially quail.

Impacts

The data collected in this study offer a strategy for simultaneously: (1) reducing the potential for non-point pollution from crop fields, (2) reducing the cost of crop production without reducing crop yield and (3) improving wildlife habitat on the southeastern farms and (4) increasing quail numbers across the region.

Farmers are cognizant of project results. Wilson County, NC farmers made aware of results of our habitat survey on their farms decided among themselves to seek cost-share for establishment of wildlife habitat (a direct result of our study). Data from our studies, especially those in Wilson County, were also instrumental in the development of multi-state (NC, SC, and VA) recommendations for inclusion, in the 1995 Farm Bill, of "green" payments for on-farm establishment of field borders and wildlife habitat.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
AS93-7

Evaluation of Recycled Paper Mulch as an Alternative to Black Plastic Mulch in Vegetable Horticulture

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Objectives

1.) Identify advantages and problems of different mulches used by vegetable growers, establish research priorities, and engage growers in the process of developing and disseminating information on mulching systems.

2.) Evaluate recycled paper film vegetable oil-impregnated paper, and organic mulches as sustainable alternatives to plastic film mulch.

3.) Disseminate information on horticultural, soil, economic and ecological merits of different mulches so growers can make informed choices appropriate to their specific sites and operations.

4.) To identify safe and cost effective means to utilize waste paper as a mulching material.

Many vegetable farmers use black plastic film mulch on tomatoes, cucumbers and other warm-season vegetables because plastic blocks weed growth, conserves soil moisture and warms the soil thereby promoting early crop maturity. Early harvests of these vegetables are important to the grower because they often sell at a higher price than later harvests. However, plastic does not add organic matter or crop nutrients to the soil. It represents a significant input of fossil fuel, and it must be picked up and disposed at the end of each season. Agricultural plastic adds significant volume to the nation's solid waste burden.

Plastic film mulches are part of a technological package that is more suited to large, mechanized, capital-intensive farms than to small farms operating with limited resources. Small, biologically managed farms often use organic mulches such as hay, straw or leaves, which provide organic matter and nutrients, protect and improve the soil, and suppress weeds. However, these materials cool the soil, which may delay ripening in tomatoes and other summer vegetables. Innovative vegetable growers have developed a variety of strategies to adapt either organic or plastic film mulching systems to their particular growing conditions and marketing needs.

Some growers and researchers have experimented with paper mulches as a biodegradable alternative to plastic that allows more soil warming than hay or straw, and at least one black paper mulch is now commercially available.

However, paper films often break down too fast, with resulting loss of soil moisture and weed control. Paper mulch can be made from 100% recycled fiber, and preliminary experiments indicate that paper impregnated with waste cooking oil enhances soil warming and may last longer than untreated paper.

The overall goal of this project is to work with growers to optimize mulching strategies in terms of horticultural performance, net costs and benefits to the grower, effects on soil conditions and other environmental impacts. Past university research and extension efforts have focused on larger, more mechanized operations, but viable small farms are an essential component of a sustainable food system. Therefore, this study aims to address the needs of smaller-scale vegetable producers

Approach

During 1993-94, about sixty-five vegetable farms were interviewed to learn about existing mulching practices and to promote information exchange. Participants were asked to describe benefits and problems with the mulches they use on warm season vegetables, pose questions that need further research, and share ideas and innovations. The information thus gathered was used in selecting experimental mulches to evaluate in on-farm field experiments. Interview participants will receive a report on the findings of this survey, and will also be invited to participate in an ongoing dialogue on mulching practices and the direction of future mulching research.

Field experiments were conducted at two biologically managed working farms in Virginia in 1993, and five farms in 1994. Four of the farms were selected from among interview participants, and the fifth site was at the residence of the principal investigator. Paste tomatoes were grown in mulches of black plastic, recycled kraft paper, oiled kraft paper, hay, straw, composted yard waste, or without mulch.

Project area
Vegetable Production

Project duration
April 1993 -October 1995

Budget:

SARE/ACE	$40,000
Matching	$10,100

Measurements included crop yields, earliness and fruit quality; weed levels; insect pest and crop disease incidence; soil temperature, moisture and available nitrogen; and labor requirements for mulch application, planting and weed control using manual methods. At the end of the season, effects of different mulches on soil health were evaluated by measuring earthworm populations, soil compaction, soil stability and permeability to moisture.

Results

Black plastic mulch enhanced early yield but usually not total crop yields or fruit quality in comparison with hay and other organic mulches. Plastic increased soil temperatures, but interfered with the entry of rainfall into the soil, thus reducing moisture reserves at midseason. Earthworm populations were also somewhat lower under plastic than under hay mulch.

Hay and straw mulches were more labor-efficient to apply than compost, and also gave somewhat better weed control. The paper mulches tested were too lightweight and broke down early in the season, resulting in loss of soil coverage and weed control. Paper treated with vegetable oil initially warmed the soil more than black plastic. Future experiments may be conducted to determine whether a heavier grade of paper treated with oil would combine adequate strength with sufficient soil warming to promote early crop yields.

Environmental costs and benefits of different mulching practices, and strategies for utilizing waste paper as mulch will be explored during winter 1994-95. Additional field trials are planned for 1995, and growers will participate in designing, conducting and evaluating these experiments so that results are of maximal relevance to vegetable growers in this region.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
AS93-8
LS94-64

Development of Suitable Area-Wide Weed Management Practices for Improved Land Utilization

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Objectives

Musk thistle, an introduced plant, is a noxious weed that impacts land utilization over a broad geographical region. This weed grows in many areas that are inaccessible and uneconomical for herbicide use or mowing. A multistate project to develop and integrate a sustainable weed management program incorporating the release and establishment of two introduced thistle-feeding biological control agents was initiated with cooperators from Georgia, North Carolina, Tennessee, and Virginia.

This regional project emphasizes farmer education and the functional integration of research technology for implementation of sustainable management of musk thistle into ongoing farm systems. The overall goal of this project is to develop and integrate a sustainable weed management program that incorporates the release and establishment of two introduced thistle-feeding biological control agents. These two agents feed specifically on thistle and pose no threat to agricultural crops.

These biological control agents have been evaluated, and are established, in Virginia, where they effectively provide sustainable control of musk thistle. Research knowledge from previous studies in Virginia will be transferred and developed into a practical, integrated sustainable management program for surrounding states. Once developed, this program can be easily adapted by personnel in other states for sustainable management of musk thistle.

The specific objectives of this proposal are to:

1.) Establish and maintain on-farm field insectaries in Georgia, North Carolina, Tennessee, and Virginia for propagation of two introduced thistle-feeding biological control agents.

2.) Develop a distribution plan to provide biological control agents to landowners and agencies for release in thistle-infested areas.

3.) Develop and implement a regional educational program (through grower education days, field days, county meetings, publications, etc.) to improve public awareness of sustainable management systems using this program as a model [the educational program will be directed at numerous targets including farmers, landowners, schools, organizations, and state and federal agencies]

4.) Assess the economic and environmental benefits of this type of sustainable weed management program.

Approach

During the initial phase of this project, biological control agents (i.e., two species of plant-feeding weevils) were released against musk thistle at selected locations in Georgia, North Carolina, and Tennessee. Approximately 15,000 head weevils, *Rhinocyllus conicus*, and 5,000 rosette weevils, *Trichosirocalus horridus*, were collected and redistributed on other thistle infested farmland in Tennessee. Approximately 12,400 *R. conicus* were collected in Tennessee and provided to cooperators for release on farmland in Georgia (5,200) and North Carolina (7,200). Approximately 1,500 rosette weevils were collected in Tennessee and released on cooperating farms in Georgia. During 1994, 1,500 *R. conicus* and 3,500 *T. horridus* were collected in Virginia; these weevils were shipped to, and released in, Alabama, Georgia, Illinois, Tennessee, and Virginia. During the year, weevils were released at 17 sites in 8 counties in Georgia, in 12 counties in North Carolina, and at 45 sites in 25 counties in Tennessee. On-farm and off-farm demonstration sites and field insectaries were established in Georgia, North Carolina, and Tennessee. Two field insectaries were established in Virginia for propagation of *R. conicus* and *T. horridus*.

During 1994, this regional project was outlined and discussed with numerous county extension agents and farmers, as well as at various grower meetings, field days, and scientific meetings. Because this program is relatively new to Georgia, North Carolina, and Tennessee, much effort was placed on contacting and explaining this project to county agents. Additional cooperators were aligned and field insectaries were designated. Information related to this sustainable weed management program was distributed through various media outlets (e.g., letters, publications, grower meetings, field days, television reports, and professional meetings).

Project area

Weed management

Project duration

June 1993- May 1996

Budget:

SARE/ACE	$165,000
Matching	$133,000

Results

This environmentally safe and economically sound management program is expected to provide environmental, economical and social benefits. These include reduced herbicide use, improved pasture management, improved water quality, improved land value, reduced fossil fuel and labor costs, reduced impact on non-target organisms, reduced risk of exposure to herbicides, reduced herbicide residues, and reduced cost of weed management (e.g., in Missouri and Virginia, management agencies and farmers save from $750,000 to $1,000,000 annually in reduced herbicide use compared to previous conventional practices).

Reducing musk thistle populations to lower levels will eventually lead to an increase in available pasture and crop lands. Valuable efforts expended to control musk thistle could be allocated more effectively and efficiently on crop or livestock production. Establishment of this biological control system should provide a self-perpetuating, sustainable control system capable of being implemented over wide areas. This project should also reduce environmental pollutants, thereby protecting the environment and natural resources. Management of weeds, such as musk thistle, using sustainable systems will demonstrate a positive approach to the current global concerns over environmental and groundwater contamination by pesticides.

This program should demonstrate the effectiveness, ease of adoption and incorporation, and economic and environmental benefits of an integrated biological control program for successful area-wide sustainable management of musk thistle. This program should also contribute to education of farmers and the general public as to the benefits of sustainable biological control programs. The success and educational benefits of this program should encourage more use of biologically sustainable programs in other states.

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
AS93-9

Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production

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Extension Poultry Science
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Objectives

The overall objective is to develop a system to manage a native nonpest soldier fly larvae (SFL) to; (1) reduce manure accumulations where livestock is housed, (2) eliminate house flies, and (3) produce tonnage of high quality feedstuff. Currently we are developing this system for caged layer houses, and specific objectives are:

1.) Determine depth of manure basin necessary to allow SFL to utilize manure accumulated during the previous winter.

2.) Characterize plant nutrients in layer manure with and without SFL.

3.) Evaluate manure volume reduction, esp. of winter accumulation.

4.) Evaluate SFL feedstuff production, quality and utilization.

5.) Determine feasibility of using this system in high-rise layer houses.

The black soldier fly (*Hermetia illucens*) occurs worldwide in the tropics and temperate regions. The larvae of this large, wasp-like fly occur in very dense populations on various organic wastes, and excludes other flies. We are developing a manure management system for caged layers using soldier fly larvae (SFL). In our system, wild populations of SFL are managed in concrete basins under the hens (could be hogs or cattle) to:

1.) Eliminate house fly breeding.

2.) Eliminate half of the manure through incorporation into larval biomass.

3.) Produce large quantities of high quality feedstuff (42% protein, 35% fat) through *self-harvest* of prepupae (ca. 65 tons/100,000 layers annually). SFL convert manure to "meat" about as well as hogs convert their feed.

This system will greatly reduce manure handling and pollution potential and increase feedstuff production. This contribution of high quality feedstuff could be a huge benefit to the livestock industry, especially if world menhaden (fish meal) stocks continue to decline. Utilization of the larval feedstuff has been extensively studied. It has been successfully incorporated into the diets of poultry, fish, and swine and compares favorably to soybean or fish meal. Hogs relish soldier fly larvae and prefer a larvae based diet over a soybean based diet. One of the most remarkable things about this system is that the larvae self-collect themselves. They do this as they are leaving the manure basin to transform into the adult. At this stage they are at their maximum size, with a large store of fat. This fat is to sustain them to adulthood, but is a valuable feedstuff. Also this stage does not feed. Considering their diet, this is a definite plus.

Approach

Our 24 by 60 foot experimental caged layer house was completed and 1700 layers were installed in September. About 41,000 soldier fly larvae were released into the outer two pits (there are 4 pits) where they will be managed. The inner two pits are being sprayed with Larvadex® to eliminate any larval activity, either house fly or soldier fly. Soldier fly activity had almost stopped when birds were installed in late September. The larvae we released should overwinter in the general area. In April these insects will become active and lay their eggs. Then we will determine if the resulting population can digest the winters accumulation of manure.

Manure samples are being taken monthly. In April, when soldier flies become active we will determine what impact they have on manure accumulation and on plant nutrients in the residual manure. Larval collections for feedstuff use will also be closely monitored.

Project area
Manure management

Project duration
Sept. 1993-April 1996

Budget:

SARE	$2,150
ACE	$49,100
Matching	$12,813

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
AS93-11

Use of Poultry Litter or Manure for Root-Knot Nematode Management on Vegetables and Field Crops

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Warren Johnson
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Carl Gibson
All farmers from SC

Phil Perry
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Project area
Waste management/pest control

Project duration
July 1993 to June 1996

Budget:
SARE/ACE $146,696
Matching $109,000

Objectives

Poultry is a large agricultural industry in the southeastern USA. The poultry industry generated an estimated income of $480 million in South Carolina and $1.5 billion in Georgia during 1994. In addition to providing income and food products, the industry generated an estimated 3 million tons of waste in South Carolina and Georgia during 1994.

Although poultry is a significant economic component of agricultural income in the southeastern USA, it also presents a significant challenge to manage and utilize the waste that is generated. Poultry manure contains significant quantities of fertilizer [Nitrogen (N), Potassium (K) and phosphorus (P) and micronutrients]. Application of litter or manure to land has been viewed as a substitute for mineral fertilizers and as a method for disposing of unwanted waste. The N, P, and K components in the manure are equivalent to an estimated $ 61 million of inorganic fertilizer.

Root-knot nematodes, a debilitating plant root parasite, are common in southern soils and are a serious problem on vegetable and field crops. On just two row crops in South Carolina (cotton and tobacco) an estimated $10 million are spent annually on nematicides to control nematodes, whereas in Georgia an estimated $54 million are spent annually to control nematodes on cotton, tobacco and peanuts.

As a result of widespread infestations of root-knot nematodes, nematicides are commonly used in many cropping systems with the potential of contaminating surface and ground water. Nitrogen rich organic amendments can be used to suppress root-knot nematodes and may provide an alternative to synthetic pesticides.

Our objectives are to:

1.) Determine if poultry manure or litter (which form is best) can be used, at environmentally sound application rates, to provide fertilizer (N, P, K and micronutrients) for a crop and suppress nematodes.

2.) Determine if the nematode suppression is due to the ammonia in the manure and litter or to organisms in the manures.

3.) Encourage the farm community to utilize this valuable resource.

Approach

Litter and manures were collected in South Carolina and Georgia and evaluated for their ability to provide plant available nutrients and suppress root-knot nematodes on cotton and squash. Tests were conducted in the field on experiment stations, on farms and also in several greenhouse tests.

Manure and litter application rates were based both on a weight basis (tons per acre, and also on a total nitrogen content of the litter and manure (90 pounds of N/acre). It is important to apply only sufficient nitrogen to assure crop growth. Any nitrogen source, either organic or inorganic, if applied in excessive rates may pollute groundwater.

We are also interested to see if manure and litter, when applied in quantities suitable for nitrogen application, suppressed root-knot nematodes. Fields were selected with a history of root-knot nematode problems (soil artificially infested in Georgia). Litter and manure was applied in fashions that a farmer would normally use (distributed on the land and incorporated by machinery) and crop growth (yield, leaf and shoot growth, nitrogen in fruits and leaves), nitrogen form (in soil) and nematode development (nematode induced root damage, and numbers of nematodes) were recorded. Litter was examined to determine what microorganisms were present.

Bacteria and fungi were isolated from the manure and tested to see if extracts from the organisms affected nematode development. Researchers in South Carolina worked on nitrogen form whereas researchers in Georgia worked on the potentially suppressive organisms present within the litter.

Results

Our work has demonstrated the ability of poultry litter and manure soil amendments to suppress root-knot nematodes in squash and cotton, two high value intensively managed crops.

In squash, yields were comparable to inorganic fertilizer commonly used in commercial squash production and in one field were nematodes were present, litters and some manures reduced nematode damage. Several difficulties in using poultry litter or manure for nematode suppression is a lack of understanding of the effects of nitrogen form (proportion of total nitrogen as NH_3 within different manures) and the role of microorganism present within the litter on nematode populations.

In order to best utilize this resource we need to know what is actually suppressing the nematodes. This information will enable us to maximize the factors responsible for nematode suppression while utilizing the nitrogen present in the manure.

As this project proceeds a greater understanding of the mechanisms involved in litter and manure induced suppression of nematodes and crop nutrition will enhance our abilities to integrate the reliable use of manure and litter into commercial production units as a nitrogen source and nematode control agent.

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Annual Report
AS94-12

Waste Management System for Loafing Areas in Dairies

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Abstract

Dairy loafing areas present unique waste management problems that are not being addressed under present farm practices. These unpaved areas leading to milking barns have high animal densities and can be a source of contaminated surface runoff and subsurface leachate to groundwater. We propose a one year exploratory project to install an innovative waste management system in the participating farmer's loafing area that will capture subsurface flow in buried drains and route this to the lagoon. Surface runoff will be reduced through the use of an economical geotextile fabric covered with fine gravel. The drains will be installed under half of the loafing area so comparisons can be made with soil sampling, ground electromagnetic inductance measurements, and groundwater sampling to determine if the drains significantly reduce nitrate leaching. The Region III office of the Environmental Protection Agency has tentatively agreed to provide additional funding to install an identical system at a second farm that has not yet been selected. Results will be rapidly disseminated to the farming community within the Hydrologic Unit through an established interagency education program and to the scientific community through conference proceedings and referred journal articles.

Objectives

The objective of this study will be to install and test a pilot system of buried drains and surface geotextile fabric in the loafing areas on two farms to reduce runoff of nitrogen and phosphorus and capture subsurface losses of nitrate and route these to the lagoons of the participating farmers.

Project area

Waste management

Project duration

April 1994-April 1995

Budget:

SARE/ACE	$68,613
Matching	$26,540

SARE/ACE
Sustainable Agriculture Research and Education
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Annual Report
AS94-14

Forage, Biomass and Biogas Integrated Systems for Animal Waste Management

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Abstract

Alternative outlets for animal waste disposal and recycling must be developed to reduce the waste stream and result in sustainable use of nutrients. We propose to integrate biogas and biomass energy production as a tool for managing animal wastes.

A large bioreactor and a covered waste lagoon on two dairies will be used to generate methane from dairy waste. Effluent from each system will be land applied to switchgrass to produce a biomass energy feedstock and animal forage. Screened fibrous solids from separated waste and switchgrass biomass will be processed via an ammonia fiber explosion process for ethanol production or enhancing as an animal feed. We will determine the waste generated and flows between each component of the system, the amount of energy produced in biogas and biomass, nutrient removal from the system in harvested biomass, fate of nutrients in the effluent in runoff, leaching, or soil accumulation, and the reduction in the waste stream.

An economic analysis will address the costs of implementing biogas/biomass systems, the potential returns, and benefits from adopting the proposed system in terms of reduced pollution, risk of regulation violation, and lessened system costs.

Information will be disseminated via workshops, tours, and print and broadcast media. Our producer/research/extension team will use a multidisciplinary (agronomy, engineering, and economics) approach to designing and implementing the system. Each team member has been fully involved in the development of the system and will be relied upon to evaluate and improve all components of the system.

Objectives

1.) Determine nutrient removal from the waste stream via energy production and nutrient fate when land applied to switchgrass.

2.) Determine total energy production from an integrated biogas-biomass system on two dairy farms.

3.) Examine the economics of the system and components including environmental impacts.

Project area
Integrated systems

Project duration
April 1994-April 1997

Budget:

SARE/ACE	$101,180
Matching	$146-760

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Annual Report
AS94-15

Integrating Grazing Systems Planning and Decision Support for Improved Sustainability and Environmental Quality

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University of Kentucky
Cattle/Forage Ext. Group

Abstract

Beef cattle producers managing cattle/forage grazing systems are faced with an ever-increasing amount of information and new technology for improving profitability, while concurrently concern is increasing on the part of both producers and the general public regarding the impact of livestock operations on environmental quality.

Protecting surface and ground water is recognized as important by environmental groups, consumers and the agricultural community. The complexity of the problem of assessing the impact of management changes on profitability and environmental and water quality has made the task of planning sustainable grazing systems more difficult.

Development of assessment tools such as Decision Support Systems, and field research to verify the tools is needed. Experiences in application of such tools on a controlled setting should be obtained. Evaluation of stream water quality as affected by the interaction between animal waste production/distribution under grazing, and manure/nutrient transport through stream-side pastures or paddocks would be valuable information for improving the sustainability of livestock/forage systems. Such an effort requires in-depth planning and coordination among a broad range of disciplines, agencies or institutions and producers.

The objectives of this project are to plan for a coordinated effort and begin the assessment process of the feasibility of combining the available decision support tools for decision-making coupled with practical farm-scale research into the interaction between grazing and stream water quality. A multi-discipline, multi-state and multi-institution effort is planned in a coordinated way to assess this important problem and determine a feasible approach to development of solutions.

Objectives

1.) Formulate (and build on existing) multi-disciplinary teams to develop a research and education plan for assessing sustainability (from both an enterprise and farm-level profitability and environmental quality aspect) of improved integrated resource management strategies for grazing.

2.) Plan for development of a research/extension project and select a site(s) where the multi-disciplinary, multi-institution team can apply selected strategies for integrated resource management (IRM) of a grazing system for beef grazing, with inclusion of monitoring/verification of the profitably and water quality impacts of the selected systems.

3.) Plan and compare the IRM system(s) to a conventionally managed grazing system (i.e. only one field) for both profitability and environmental impact on the intensively monitored site.

4.) Plan for later extension of the project results to multiple demonstration sites and to other producers through workshops and training opportunities. Present the advantages of IRM for grazing systems as documented in the project for both profitability and environmental quality.

Project area

Integrated systems

Project duration

April 1994-April 1995

Budget:

SARE/ACE	$27,500
Matching	$67,115

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Annual Report
AS94-16

Development of Guidelines for and Demonstration of Efficient Treatment of Swine Lagoon Wastewater by Constructed Wetlands

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Abstract

Animal wastewater management practices currently in use are highly criticized as stand alone systems. Due to violations of surface and groundwater quality attributed to inefficient and mismanaged waste treatment systems, regulatory agencies are pursuing more rigorous control of water quality. There is an imminent need to develop and evaluate cost-effective, highly efficient, and low-energy systems for treatment of agricultural wastewater. Constructed wetlands appears to be such a system; however, insufficient data are available for the development of guidelines for the design and long-term operation of wetlands for the treatment of more concentrated wastes such as animal waste effluents.

Wetlands that were constructed according to best available recommendations and which have reached a state of stabilization will serve as the model for evaluating the efficacy of constructed wetlands for treatment of animal waste effluents.

Three wastewater loading rates contributed by effluent from a two-stage swine manure lagoon will be discharged each into 0.1 acre wetlands and the effluent from each of the wetlands will then pass by gravity to a second set of 0.1 acre wetlands. Nutrient concentrations in the influent and effluent of the wetlands will be monitored to determine the waste treatment efficiency of the system operated at three loading rates over a 3-year period.

The relationship of nutrient loading on effluent quality as affected by seasonal variations will play a major role in assessing the practicality of the wetlands technology for animal waste treatment and the potential impact of the technology on the environment.

A major goal of the project is to develop guidelines for the successful operation of constructed wetlands and to demonstrate the technology to animal producers and to state and federal water quality agencies which will rule on the acceptability of the technology.

Objectives

1.) Evaluate and demonstrate the bioremediation potential of constructed wetlands operated at three wastewater loading rates for efficient treatment of swine lagoon wastewater and to develop best management practices for use of constructed wetlands with input from swine producers and other project cooperators.

2.) Monitor deep wells and lysimeters installed in and around the wetlands site to measure the impact of the wetlands on groundwater quality.

3.) Demonstrate best management practices for efficient operation of constructed wetlands to livestock producers and regulatory agencies through on-site field day programs, and with input from project cooperators, prepare a handbook as an operational guide.

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Project area
Waste management

Project duration
July 1994-July 1997

Budget:
SARE/ACE $130,325
Matching $78,553

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Annual Report
AS94-17

Transitioning to Sustainable Methods in Sugarcane Farming

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Edward P. Richard, Jr.
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All from Louisiana

Abstract

Sugarcane farming in Louisiana presently uses methods of intense aerial application of pesticides during the growing season and burning of leaves surrounding the stalk at harvest time.

This project provides for designing and building equipment that:

1) Minimizes pesticide drift from aerial application, reduces pesticide inputs, soil erosion caused by synthetic inputs, pollution of waterways from pesticides and soils.

2) Eliminates smoke pollution from burning cane leaves during harvest and recycles stripped leaves as mulch for over wintering soils and freeze protection for young cane shoots.

Burned fields leave bare soils and vulnerable shoots. The design of the equipment involves the following: There is only one power unit which will serve two different operations.

1.) The Hi Cycle sprayer trailer is designed for use during the growing season to protect the applicator while he releases insecticide specifically on the top leaves of the cane stalk.

2.) The Hi Cycle sprayer trailer can be unhooked from the power unit and replaced by a Hi Cycle stripper trailer which strips the leaves from the cane stalk and blankets the mulch on the entire row. Dissemination of results of this specially designed and built equipment will be through demonstration at farm field days, in conjunction with the Louisiana State University System, environmental groups, non-profits and most importantly, farmer to farmer demonstration.

Objectives

Our primary objective is to design and build a piece of equipment which will be used to accomplish the following:

1.) Eliminate or reduce aerial application of pesticides in sugarcane production.

2.) Reduce the volume of pesticide application and combat pests (sugarcane borer) more efficiently.

3.) Reduce drift and overspray which has contributed to human health problems, fish kills, and wildlife damage.

4.) Decrease capital input of sugarcane farming and make the operation more sustainable while farmers look for alternatives to diversify their operations.

5.) Improve air quality especially during harvest time when burning sugarcane is prevalent in a 22-parish area.

6.) Provide a mulch for stubble cane fields where sugarcane has been cut and stalks have been removed, thus preventing run-off and providing winter protection to new shoots.

7.) Provide improved pesticide safety for applicators.

Project area
Reduced inputs

Project duration
1 year

Budget:

SARE/ACE	$15,000
Matching	None

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Extension Training Grants

Inaugurated in 1994, the Extension Training program is consistent with the mission-oriented focus of the SARE/ACE program. The goal of the program is to develop understanding, competence and ability to teach concepts relating to the establishment of sustainable agriculture production systems to extension staff, Soil Conservation Service staff and other professionals involved in providing information to farmers and ranchers.

ACTIVE EXTENSION TRAINING PROJECTS

Project #	Title	Lead Institution	Project Coordinator	SARE Funds	Matching Funds	Project Duration
LST94-1	Southern Region Sustainable Agriculture Training Consortium	North Carolina State University	R. Crickenberger	$ 199,620	$ 14,875	1 year
LST94-3	Management Intensive Grazing: Foundation of Sustainable Agriculture in the South	University of Southwestern Louisiana	H.A. DeRamus	$ 63,461	$ 109,463	2 years
LST94-4	Sustainable Dairy Systems Manual and Training	University of Tennessee	C.D. Garland	$ 90,000	$ 277,920	2 years
LST94-7	Evaluating Sustainability: Gaining Insights	University of Florida	M.E. Swisher	$ 56,269	$ 13,467	1 year
LST94-5	Sustainable Cotton Production for the South	Auburn University	E.A. Guertal	$ 10,000	$ 11,898	2 years
LST94-2	Environmentally and Economically Sustainable Use of Rangeland	Texas A&M University	J.F. Cadenhead	$ 72,570	$ 72,570	1 year
LST94-6	Extending Sustainable Agricultural Concepts and Practices to Traditional Agricultural Advisors	Clemson University	P. Porter	$ 11,700	$ 10,500	1 year
TOTAL EXTENSION TRAINING PROJECTS				**$ 503,620**	**$ 460,693**	

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Sustainable Agriculture Research and Education
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Annual Report
Project LST94-1

Southern Region Sustainable Agriculture Training Consortium

Abstract

The Southern Region Sustainable Agriculture Training Consortium will facilitate and coordinate sustainable agriculture training for agricultural professionals. The consortium will include individuals and organizations in the region with an interest in sustainable agriculture. The ultimate aim of the consortium is to develop and manage the regional training program through a participatory strategic planning process. The consortium will consist of a large stakeholder group, a nine- to twelve-member executive leadership committee and a three-member project management team. The project management team will consist of Roger G. Crickenberger, NCSU; John O'Sullivan, NC A&T State University; and Jim Lukens, NCAT-ATTRA.

Objectives

1.) Develop and build consensus for a regional training agenda.

2.) Document training needs and priorities for the SARE/ACE Administrative Council to use when soliciting competitive training projects.

3.) Develop and deliver generic process training such as conflict and risk management, program evaluation, systems concepts and other topics suitable for region-wide delivery.

4.) Provide support as appropriate for regional and state training project leaders.

5.) Establish and maintain linkages to training programs in other regions.

Project Coordinator

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Project area Training

Project duration
July 1994-June 1995

Budget:
SARE/ACE $ 199,620
Matching

SARE/ACE
Sustainable Agriculture Research and Education
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Annual Report
LST94-2

Environmentally and Economically Sustainable Use of Rangeland

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University

Abstract

Costs and environmental concerns will cause chemical use methods for control and eradication of woody plants on rangelands to become unavailable. Methods and concepts must be developed and educational training conducted that will achieve environmentally and economically sustainable use of rangeland. This project will teach skills to allow for sustainable livestock grazing, control of woody plants with minimal chemical input, and decrease the effects of drought.

Objectives

1.) Train agency personnel in setting goals and objectives and in learning techniques to assist ranchers in systematically developing alternative strategies to meet their goals and objectives.

2.) Implement the elements of the strategies for sustainable rangeland management.

3.) Evaluate the training and implementation project for further development into a sustainable rangeland management program to be made available to ranchers nationally and internationally.

Project area
Training

Project duration
August 1994-July 1995

Budget:

SARE/ACE	$ 72,570
Matching	$ 72,570

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual report
LST94-3

Management Intensive Grazing: Foundation of Sustainable Agriculture in the South

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Abstract

This training project will provide comprehensive management intensive grazing (MIG) education to Cooperative Extension Service personnel, Soil Conservation Service personnel, and innovative livestock producers in the humid, temperate and subtropical Gulf South Region. Four MIG workshops will be conducted annually on both cool-season and warm-season forages. Each 3-day workshop will consist of both classroom and field experiences. Supporting fact sheets and videos of MIG will be produced.

Objectives

1.) Demonstrate via lectures and hands-on field training the economic, environmental and agricultural benefits of MIG relative to conventional agriculture.

2.) Illustrate the role of MIG in comprehensive sustainable agriculture planning.

3.) Train participants to assess farm suitability (soils, pastures, building, equipment) for MIG.

4.) Train participants how to teach field management to other farmers.

5.) Develop and distribute training videos that will supplement participant knowledge.

6.) Develop and distribute fact sheets on MIG in the South for use by participants and clientele.

Project area
Training

Project duration
July 1994-June 1996

Budget:
SARE/ACE $ 63,461
Matching $ 148,550

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
LST94-4

Sustainable Dairy Systems Manual and Training

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Abstracts

An interdisciplinary dairy systems costs, returns and production requirements manual and computerized data base will be prepared, pilot taught, evaluated, revised and distributed. Farmers and rural leaders in Tennessee and Kentucky will be actively involved in the development, evaluation and use of the training materials. The systems approach will be used in developing actual farm plans with at least 110 farms. The manual will include chapters on forages, feeding, waste management facilities and a chapter combining all phases of the dairy farm into a systems approach to management. Environmental and sustainability concerns will be incorporated into the systems process.

Objectives

1.) Prepare, pilot teach and evaluate a dairy systems manual and computerized whole farm planning data base for the Southern region.

2.) Develop and prepare teaching materials on technical production relationships and costs and returns for appropriate crop and livestock enterprises including facilities, machinery investment and labor requirements for alternative technologies.

3.) Train Extension agents in Kentucky and Tennessee to use and teach from the manual and conduct educational programs with at least 500 farm families with dairies.

4.) Use the systems manual and computerized data base to develop intensive farm and financial plans with at least 110 Kentucky and Tennessee farm families.

5.) Use the dairy systems manual to teach SCS and ASCS personnel, agricultural lenders and other professional agricultural workers, environemntal groups and rural people about sustainabledairy systems.

6.) Use the dairy systems manual to demonstrate to others the importance of a systems approach to management.

Project area

Training

Project duration

July 1994-June 1996

Budget:

SARE/ACE	$90,000
Matching	$277,920

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
LST94-5

Sustainable Cotton Production for the South

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Abstract

Alabama is home to the two oldest continuous sustainable cotton research projects in the world. Results from almost 100 years of these studies will be used as a starting point to design on-farm sustainable cotton production handbook systems that use crimson clover to provide nitrogen and winter cover. Demonstrating on-farm that sustainable large-scale cotton production is environmentally and economically possible will speed the adoption of these techniques by growers. On-farm demonstrations will be combined with agent training sessions, resulting in the production of a handbook of "Sustainable Cotton Production" for extension use.

Objectives

1.) Use the concepts of sustainability as illustrated in the 98-year Old Rotation to conduct on-farm sustainable cotton production demonstrations.

2.) Prepare research bulletins and popular brochures on the benefits of sustainability as demonstrated by 98 years of continuous, sustainable cotton production and on-farm demonstrations.

3.) Compute cotton sustainability and total social factor productivity indices in order to assess the ability of cotton to remain a viable economical and environmentally compatible crop for Alabama.

4.) Conduct workshops for county agents, providing training necessary to conduct on-farm sustainable production demonstrations.

Project area Training

Project duration

July 1994-July 1996

Budget:

SARE/ACE	$ 10,000
Matching	$ 11,898

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annua Report
LST94-6

Extending Sustainable Agriculture Concepts and Practices to Traditional Agriculture Advisors

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Abstract

This training project will take Cooperative Extension Service personnel, and agricultural personnel from other agencies onto farms of people whose ideas and concepts about sustainable agriculture don't fit into the conventional agricultural paradigm of today. The idea is to expose the targeted audience to approaches and philosophies which traditionally are viewed with skepticism by mainstream agricultural but which are being promoted as successful by the nontraditional practitioners. The exposure will be on-farm, in relatively small groups to enable in-depth, one-on-one dialogue. The objective is to give the targeted audience a better appreciation for approaches and philosophies of nontraditional practitioners and others who advocate changes in conventional agricultural practices.

Objectives

1.) Expose Cooperative Extension Service personnel as well as personnel from other agencies such as SCS, ASCS and Land Resources Commission (henceforth referred to as the target audience) to concepts of sustainable agriculture from farmers who are successfully practicing unconventional methods of crop and livestock production.

2.) Expose the target audience to concepts and philosophies of environmentalists and others who feel they have a vested interest in seeing changes in conventional agricultural practices and to engage these groups in meaningful dialogue on these concepts and philosophies.

3.) Create a greater appreciation on the part of the target audience for concepts and philosophies of those advocating change in the conventional agricultural practices of today.

Project area
Training

Project duration
August 1994-August 1995

Budget:

SARE/ACE	$11,700
Matching	$10,500

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
LST94-7

Evaluating Sustainability: Gaining Insights

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Abstract

A training of trainers program designed to introduce participants to a range of factors important to the overall concept of sustainability will be delivered at four sites in the Southern Region. Classroom sessions delivered by satellite from the University of Florida to Clemson University, the University of Kentucky, and the University of Arkansas at Pine Bluff will be accompanied by field studies on local farms led by trainers at the participating institutions. The classroom sessions will be recorded on video for use in other regions and by other institutions. A training manual will be developed and revised for use with the video programs. Evaluation will include a pre- and post test to measure learning, a test of course quality, and a follow-up evaluation of application.

Objectives

1.) Provide partaicipants with an enhanced understanding of overall concepts of sustainability and of the multi-faceted nature of sustainability.

2.) Provide participants with several approaches and tools that they can use in their daily work situations to better evaluate how their activities contribute to the overall sustainability of agricultural production.

3.) Provide participants the opportunity to use these new tools in an actual case study and determine their utility in their own work situations.

Project area
Training

Project duration
August 1994-June 1995

Budget:

SARE/ACE	$56,269
Matching	$13,467

Producer-Initiated Grants

The Producer-Initiated Grants (PIG) program was started in 1993 in order to capture on-farm producer experience and enrich overall SARE/ACE programming. Producer-Initiated Grants are research or education projects in the area of sustainable agriculture that are developed, coordinated or conducted by producers (farmer/rancher) or producer organizations.

1994 PRODUCER-INITIATED GRANTS

Project #	Title	State	Project Coordinator	SARE Funds	Matching Funds	Project Duration
PIG94-1	Controlling Aphids With Harmonia Lady Beetle in Pecan Orchards	TX	M. Adams	$ 4,600	$ 4,500	2 years
PIG94-2	Intercropping Peas and Beans to Improve Soil for Blueberries	AR	S. Bradshaw	$ 6,470	$ 4,944	3 years
PIG94-3	Plant Tissue Analysis and Beneficial Insects in No-till Cotton	GA	C. & L. Harper	$ 3,450	$ 6,000	1 year
PIG94-4	Nutrient Evaluation and On-site Composting of Poultry Litter	GA	A. Hickox	$ 3,000	$ 2,275	1 year
PIG94-5	Vegetable Marketing Strategies for a Small Farm Co-op	SC	C. Inabinet	$ 10,000	$ 1,850	3 years
PIG94-6	Insect Pest Management for Cotton	GA	B. Johnston	$ 8,700	$ 12,950	2 years
PIG94-7	Perennial Warm Season Grasses as Summer Pasture	NC	N. & K. Jordan	$ 733	$ 1,767	1 year
PIG94-8	Meat Goats for Weed Control and Alternative Income in Cattle Operations	NC	T. Kern & L. Creekmore	$ 2,020	$ 4,200	1 year
PIG94-9	Production and Marketing Strategies for Shiitake Mushroom Growers	TN	A. Love	$ 3,122	$ 6,212	1 year
PIG94-10	Site Specific Applications of Seed/Fertilizer/Chemicals	TX	R. & B. Meinen	$ 10,000	$ 20,900	2 years
PIG94-11	Clover Clippings as Replacement for Chicken Litter in Compost	AL	J. Mills	$ 6,160	$ 6,040	1 year
PIG94-12	Swine Lagoon Management System	TN	K. Moore	$ 10,000	$ 20,550	1 year
PIG94-13	Plant Shelters to Extend the Growing Season for Herbs	NC	R. Morgan	$ 3,550	$ 3,350	1 year
PIG94-14	Cut Flowers as a Sustainable Agricultural Alternative	OK	J. Rose & V. Stambeck	$ 6,000	$ 3,100	1 year

Project #	Title	State	Project Coordinator	SARE Funds	Matching Funds	Project Duration
PIG94-15	Farmer-to-Farmer Transfer of Knowledge About Rotational Grazing	AR	L. Schroeder	$ 9,988	$ 22,133	1 year
PIG94-16	Clover Cover Crops, Weed Management and Consumer Tolerance to Insect Damage	SC	H. & S. Skipper	$ 4,710	$ 5,918	2 years
PIG94-17	Shrimp Polyculture in Existing Farms	KY	M. & C. Straw	$ 3,109	$ 1,850	1 year
PIG94-19	Biological Control of Flower Thrips in Pepper Fields	FL	T. & T. Winsberg	$ 9,950	$ 10,900	1 year
TOTAL PRODUCER-INITIATED GRANTS				**$ 105,562**	**$ 139,439**	

SARE/ACE
Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
Project PIG94-1

Controlling Aphids with Harmonia Lady Beetle in Pecan Orchards

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Background

Yellow pecan aphids are an annual and nearly universal insect pest of pecans for which no sustainable control exists. A number of foliar applied insecticides are registered for yellow aphids, but control is poor and the insects often resurge after insecticides are applied. The soil-applied systemic insecticide Temik is registered and effective but is expensive ($45 and up per acre), can leach into ground water and may produce tolerance among yellow aphids after several years use.

A species of lady beetle, *Harmonia axyridis*, was imported from Japan and released in Georgia from 1979-81 by USDA entomologists. It has proved to be an excellent predator of aphids that attack trees and ornamentals, especially yellow aphids in pecans. Although the Harmonia lady beetle is now common in Georgia, Florida and some areas of Louisiana, it did not become widespread until 11 years after its release. Although a few individuals of this species have been found in Texas, it will likely be several years or longer before there are sufficient numbers in Texas to provide effective aphid control.

Objectives

1) Increase the biological control of yellow pecan aphids in Texas by introducing the Harmonia lady beetle to pecan growers throughout the state.

2) Increase producer awareness and knowledge of the Harmonia lady beetle and other beneficial insects and inform producers of their use in a biologically intensive IPM program.

3) Develop and distribute an Extension bulletin outlining the use of the Harmonia beetle in a biologically intensive IPM program.

4) Distribute a questionnaire to growers involved in the Harmonia release program to determine the level of beetle establishment and if they reduce levels of yellow aphids.

Approach

Twelve thousand beetles were collected where they overwinter in masses throughout sheltered areas of Georgia and Florida. They were stored in refrigerators at the Texas A&M Research and Education Center in Dallas and shipped to cooperating pecan growers in Texas who are using their operations as nursery orchards. The beetles became established at all but one of the nursery sites in the 1994 growing season. The sites are now being monitored to see how the beetles affect the aphid populations.

Vetch or clover has been planted in test plots to attract pea aphids as an early season food source for the beetles and other predators. Lady beetles normally multiply in these legumes in the spring and then move into pecan trees to feed on yellow aphids in early summer. The 1995 beetle populations in test plots will be compared to the populations in orchards that have no vetch or clover. Once Harmonia lady beetles become common in Texas, other pecan growers will be invited to collect beetles from the nursery orchards for transport to their own orchards. The beetles should also disperse naturally.

Outreach

Education and outreach efforts will include an Extension bulletin to teach growers how to identify and use the Harmonia lady beetle in a biological control program for yellow pecan aphids. Presentations will be made at Extension pecan programs throughout the state, the annual conference of the Texas Pecan Growers Association and through articles in *Pecan South Magazine.*

The project will be evaluated by monitoring densities of Harmonia lady beetles and yellow aphids in both the nursery orchards and adjacent non-release orchards. Cooperating producers will be interviewed about the impact of the release and will be asked to complete a questionnaire one year later to evaluate the program.

Project Area
Biological control (IPM)

Project duration:
1 year

Budget

SARE/ACE:	$4,600
Matching	$4,500

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Southern Region

Annual Report
Project PIG94-2

Intercropping Peas and Beans to Benefit Blueberries

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USDA-ARS,
Range Scientist
Appropriate Technology
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Background

In the Ozark Mountain region of Arkansas, where previous cotton farming depleted the soil, blueberries have become an important agricultural industry because they can tolerate acidic and rocky conditions. The soil is only four to six inches deep and requires additions of organic matter such as wood chips or other mulch in order to remain productive.

Objectives

1) Investigate the effect of intercropping leguminous species and blueberries on blueberry productivity and soil nutrient status.

2) Investigate the effect of different mulch types on blueberry production and soil nutrient status.

Approach

The peas and beans will be planted in rows on each side of the blueberry bushes, an area 18-24 inches wide that is usually covered with purchased mulch. During the growing season, the peas and bean will replace the mulch as a weed suppressant. After the peas and beans are harvested for sale, the vines will be cut with a mower and tilled into the soil.

Soil samples will be taken prior to the planting and at intervals during the growing season. The samples will be tested for increased organic matter, ph and soil nutrient content. The data from the samples will be compared to samples taken from other areas of the farm that have bare ground, straw mulch or pine mulch. The profit per acre will also be calculated to determine the economic benefit of the added pea and bean crops compared to only the blueberries. It is anticipated that data from the three years of the project will show continued improvement of the soils planted in the legumes and continued increased profit per acre.

Outreach

Field days and workshops will make use of slides taken during the project to document the stages of production. Slides and other records will be used in articles targeted to sustainable agriculture publications.

Project Area:
Intercropping

Project Duration
3 years

Budget
SARE/ACE: $6,470
Matching: $ 4,944

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Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
Project PIG94-3

Plant Tissue Analysis and Beneficial Insects to Reduce Chemical Inputs in No-Till Cotton

Project Coordinator

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Cooperators

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Rick Reed
County Director University of Georgia Cooperative Extension

Background

Three sustainable agriculture techniques commonly used in other regions are rarely used in southern cotton production: 1) no-till planting, 2) scouting for beneficial insects and 3) plant tissue analysis for developing a fertilizer program

Objectives

1) Modify a no-till planter for use in a legume cover crop-cotton relay cropping system.

2) Implement a scouting program to track beneficial insect populations in a cover crop-cotton relay cropping system.

3) Implement an integrated soil and plant testing program to monitor nutrient levels in a cover crop-cotton relay cropping system.

Approach

The project will be conducted on 800 acres of cotton in south Georgia. The cotton will be part of a relay cropping system using winter legumes. Commercial no-till planters will be modified to get adequate plant stand through the winter residue. Extension pest management specialists will train scouts to keep track of beneficials and then plan a pesticide program based on the scouting data. Likewise, the fertilizer applications will be based on the results of the regularly scheduled soil and plant tissue analysis.

Outreach

Education and outreach for the three-year project will include field days and open house events. Between the scheduled public events, individual growers, agribusiness representatives, brokers and other people interested in sustainable techniques for cotton production will be invited to the farm for tours.

Project Area

Cropping systems

Project duration

1 year

Budget

SARE/ACE:	$3,350
Matching:	$7,000

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Southern Region

Annual Report
Project PIG94-4

Nutrient Evaluation and On-Site Composting of Poultry Litter

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Cooperators
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Background

Regulations in the Coastal Nutrient Management Zone are making it necessary for poultry farmers to adopt more efficient waste management programs. Lack of information about the proper use of poultry manure is a constraint to poultry farmers who wish to apply it to their own land and to other farmers who would like to purchase it from the poultry producers. The information gap includes basic questions concerning rates and methods of application for different crops.

Objectives

1) Establish a demonstration illustrating the effect of rate and application methods of poultry litter applied to corn, soybeans and/or tobacco.

2) Utilize soil, plant tissue, manure and water tests to compare the effect of different poultry litter application rates and methods on crop and soil properties.

3) Conduct a field day to demonstrate the use of poultry litter as a nutrient source in corn-soybean-tobacco production systems.

Approach

A replicated demonstration will be established on a farm in Georgia that produces corn, soybeans, tobacco and local market vegetables. By testing manure, soil, plant tissues and local surface/ground water supplies, the investigators hope to track and record nutrient amounts and transfer throughout the growing season. Crop yields will be compared to yields from fields treated with different poultry manure application rates and methods as well as to fields treated with other kinds of fertilizers. The data will be used to help farmers determine the nutrient content of manure and the best application rate and method for a particular crop.

Outreach

Education and outreach will be accomplished through a field day, a published extension report and a presentation at the county corn production meeting.

Project Area
Poultry litter

Project Duration:
1 year

Budget:

SARE/ACE:	$ 3,000
Matching	$ 2,275

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Sustainable Agriculture Research and Education
Agriculture in Concert with the Environment
Southern Region

Annual Report
Project PIG94-5

Vegetable Marketing Strategies for a Small Farm Co-op

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Cooperators
South Carolina State University Small Farmers Technical Assistance and Training Project

Clemson University Cooperative Extension

Background

In order to succeed, farmers who belong to market co-ops must learn to supply produce continually in a given time period and also how to apply marketing techniques and strategies to that produce. Such techniques and strategies include proper preparation, storage, packing and shipping.

Objectives

1) Conduct a series of vegetable marketing workshops focusing on readying, transporting and marketing produce to commercial markets.

2) Evaluate current marketing strategies to determine strengths and weaknesses.

3) Develop an evaluation/assessment plan to determine the effectiveness of workshops and seminars.

4) Submit annual reports concerning farmers' attitudes and income gains after applying various marketing strategies and techniques.

5) Host an annual demonstration marketing field day to include other farmers in the area and other cooperatives.

Approach

Project leaders will arrange with commercial vendors and agricultural service representatives to provide a co-op of 55 small farms with a series of workshops that focus on techniques for timely production and on preparing, transporting and marketing produce in a more profitable manner.

The project will begin with an evaluation of the current marketing strategies of the co-op to determine strengths and weaknesses. The seminars conducted over the three-year duration of the project will build on the strengths of the current strategies to develop a progressive marketing program.

Outreach

Evaluations to assess the program's impact on increasing income and maintaining/enhancing marketing skills will be accomplished through annual reports. Participating farmers will hold a demonstration marketing field day each year to show what they have learned. Besides their primary purpose of evaluation, those field days will also provide a learning opportunity for other farmers and cooperatives.

Project Area:
Marketing

Project Duration:
3 years

Budget:

SARE/ACE:	$10,000
Matching	$ 1,850

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Annual Report
Project PIG94-6

Insect Pest Management for Cotton

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Lamar Martin
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Project Area:
IPM for cotton

Project Duration:
2 years

Budget	
SARE/ACE	$ 8,700
Matching	$ 12,950

Background

Cotton production has historically involved the use of large amounts of pesticides. The eradication of the boll weevil from the Carolinas, Georgia and Florida has provided an opportunity to move pest management on cotton to a more sustainable system. The other major cotton pests such as the bollworm, beet armyworm, thrips and aphids are attacked by a wide variety of natural enemies that with proper management can suppress these pests. These beneficial insects can be of major value to the economic success of cotton and to the transition to more sustainable agriculture.

Objectives

1) Evaluate the effect of cover crop, tillage and cultivar selection on cotton pests and beneficial insect populations.

2) Host two field days to demonstrate ecologically based approaches to cotton production.

Approach

The project will take place on a farm in south Georgia that consists of 900 acres of cotton, 450 acres of peanuts and 50-75 acres of corn. Although the demonstration will involve only cotton, the results will eventually be applied to the peanut and corn acreage.

The two-year project will compare the benefits of fields managed by an ecologically based approach to insect problems with conventionally managed fields. During the first year, two fields 10-12 acres in size will be used in the evaluation. At each location the ecologically based approach will be compared to the conventional approach. A cover crop and conservation tillage will be used in the ecologically based approach to foster the buildup of beneficial insects and to relay them into the cotton. Cotton varieties will be chosen based upon their suitability in an IPM program.

All pest control interventions will be made cautiously with consideration given to potential impact on beneficials. Also, only bioinsecticides such as *Bacillus thuringiensis* will be used for any pest outbreaks. Moisture retention, prevention of soil erosion and mulch for weed control will be noted and evaluated as potential additional benefits of the cover crop and minimum tillage.

Conventional tillage and pesticide applications will be used on comparison fields. Based on results of the first year, two 20-30 acre fields will be used during the second year to demonstrate the best sustainable practices. It is anticipated that the entire farm eventually will be converted to sustainable methods.

Outreach

Education and outreach will take place at two field days per year during the two-year project. One field day will be scheduled early in the growing season to explain the design and methods of the project to interested parties. The second field day will take place near the end of the season to demonstrate and discuss the results of the comparisons.

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Annual Report
Project PIG94-7

Perennial Warm Season Grasses as Summer Pasture

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Soil Conservation Service

Soil and Water Conservation
District

Background

Each year more dairy farmers are discovering the benefits of grazing their herds to reduce feed costs. However, the majority of forage crops in North Carolina are cool season, which creates a feed deficiency for grazing cattle during the summer months. If warm season perennial grasses could be added to the pasture forage, the grazing season would be extended and the dairy farmer could realize more profit by spending less on feed.

Objectives

1) Establish and evaluate cost-effectiveness of warm-season, perennial pastures for sustainable dairy production.

2) Hold a field day to demonstrate the use of warm-season perennial grasses as a component of an intensive grazing system for dairies.

Approach

This project will evaluate two warm season species, flaccidgrass and Eastern gamagrass, planted on seven acres of a dairy farm that has 80 cows. The grasses will be evaluated both as forage and as the basis of a feed ration. Evaluation of the profitability will be determined by comparing the feed costs and returns above feed costs over the past several years to the costs and returns above cost during the project year.

Outreach

Education and outreach will take place during field days at planting time and later in the summer to demonstrate to other producers the benefits of warm season forages and how they fit into a grazing scheme for dairies.

Project Area:
Dairy forage

Project duration:
1 year

Budget	
SARE/ACE	$ 733
Matching	$ 1,767

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Southern Region

Annual Report
Project PIG94-8

Meat Goats for Weed Control and Alternative Income on Cattle Operations

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Background

The demand for goat meat is exceeding supply in North Carolina and other East Coast states. In North Carolina a new slaughter facility has opened to supply domestic and export markets. With the continual influx of immigrants who prefer goat meat, the demand will increase. While goats have been used for biological control of weeds, brush, multiflora rosa and kudzu on farms, there is a limited supply of meaty type animals available to producers.

Very little research has been conducted to find out what breed of goat would produce the most rapid growth and the heaviest carcass in the Southeast environment. Finding a meat goat that produces more per acre per year (because of more kids born) can have a significant impact on income. Finding a breed which provides a higher dressing percentage will bring premium prices.

Objectives

1) Evaluate and compare Tennessee stiff-leg goats to existing goat herd in terms of meat production performance and compatibility with beef cattle.

2) Maintain production records of animal breeding and gain performance, slaughter characteristics and price.

3) Share production records and cooperate with NC State Cooperative Extension in disseminating information about meat goat production.

4) Host a field day/tour to demonstrate the integration of meat goat production in beef cattle operations.

Approach

The research will take place on a 130-acre cattle ranch that has traditionally used goats to improve pasture for cattle. By adding the income from an annual goat crop, the producers have the potential to make a profit on what was an underutilized resource. The added income could also help protect the operation from fluctuating beef prices.

This project will compare the production performance of a herd of 26 mixed breed goats to the production performance of a herd of 25 Tennessee Stiff-leg goats known for heavy muscling and high kid counts. The Stiff-leg goats have two kid crops per year and average three kids/doe. Most local or native breeds kid only once per year, averaging 1.8 kids/doe.

The Halal Meat & Food Corporation of North Carolina will purchase all the kids and report the dressing percentages for comparison purposes. Breeding records, gain performance, slaughter characteristics and price will also be compared between the two herds.

Outreach

Education and outreach will be dispersed through Extension agents in several counties. The project coordinators will host a field tour at the farm and also make a presentation at the Regional Meat Goat Conference sponsored by the Mid Carolina Council of Governments.

Project Area:
Goats as alternative income

Project duration:
1 year

Budget:

SARE/ACE:	$ 2,020
Matching	$ 4,200

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Agriculture in Concert with the Environment
Southern Region

Annual Report
Project PIG94-9

Production and Marketing Strategies for Shiitake Mushroom Growers

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Background

Shiitake mushroom producers in the Tri-State area of East Tennessee, southwest Virginia and southeast Kentucky face challenges of seasonal production, market accessibility, packaging for retail sales and consumer education. Current production has been scaled back to prevent flooding the bulk sales wholesale market. Producers are able to produce more mushrooms than can be marketed at peak seasonal production periods. Producers must develop growing methods that will provide a steady year-round supply for retail sale. A concentrated cooperative retail marketing plan must be developed and implemented.

Objectives

1) Conduct research on vented plastic containers for mushrooms.

2) Develop, design and print an attractive product label for fresh shiitake mushroom packages.

3) Investigate appropriate storage, nutrition and recipes for shiitake mushrooms.

4) Develop an educational brochure for market promotion and development.

5) Conduct marketing feasibility studies with wholesalers and retailers to determine the best retail marketing strategies.

6) Conduct research to determine environmentally and economically productive methods of producing shiitake mushrooms year-round.

Approach

Shiitake mushroom sales the first year after the project will be compared to sales the year prior to the project. Also measured will be the changes in numbers of mushroom growers, with an increase being contributed to the project. Retail vendors and growers will be surveyed for changes in satisfaction levels.

Outreach

Outreach will include shiitake production workshops, news releases and reports to SARE/ACE.

Project Area:
Shiitake mushroom production and marketing

Project Duration:
1 year

Budget

SARE/ACE:	$ 3,122
Matching:	$ 6,212

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Annual Report
Project PIG94-10

Site Specific Applications of Seed, Fertilizer and Chemicals

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Background

Although technology now exists to make site specific inputs of seed, fertilizers and chemicals feasible and profitable, field-wide or farm-wide applications are still the norm throughout the South and the rest of the United States. Research has shown that applying these inputs according to soil type and productivity will reduce costs, increase profitability and reduce environmental hazards.

Objectives

1) Divide and map field areas by soil type.

2) Obtain soil and plant samples in each mapping unit, and fertilize, plant and apply pesticides as indicated by test results in each mapping unit.

3) Utilize global positioning systems technology and mapping to maintain site-specific cost, return and environmental records. Monitor water runoff on test areas.

4) Compare economic, agronomic and environmental data from fields receiving site-specific management to adjoining fields using current practices.

Approach

This project will evaluate the use of site specific inputs on land that is being converted to a no-till operation. A 132-acre portion of a 2,000-acre family farm will be devoted to five crops (corn, grain sorghum, wheat, cotton and soybeans) for the duration of the two-year project. The results will be compared to an adjoining field that will be conventionally farmed to produce the same five crops. If the results indicate that no-till, site specific techniques are more feasible and profitable than conventional methods, the entire farm will be converted to the prescription farm process and technology.

In the no-till, site specific field the following practices will be used:

1) Map soils using the AgMapp technology to show soil types in each crop area.

2) Sample soils in each crop area.

3) Fertilize, plant and apply chemicals according to crop and soil type needs.

4) Gather yields by soil type at harvest.

In both fields the following will take place:

1) Monitor crop progress with infra-red photography

2) Use global positioning systems (GPS) technology, computers and AgMapp system to insure accuracy of all operations.

3) Monitor water runoff for environmental impact.

4) Record cost and return data.

Outreach

Evaluation will be in the form of a progress report for each crop in each year of the project. The reports will include economic analysis, problems and successes for each crop. The reports will be part of the education and outreach when they are sent to all Extension agents and SCS personnel in North Texas as well as to the major agricultural publications. The reports will be made available to all producers in North Texas and anyone else who is interested. There will be field days and tours each year of the project.

Project Area:
Cropping systems

Project Duration:
2 years

Budget
SARE/ACE: $ 10,000
Matching: $ 20,900

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Southern Region

Annual Report
Project PIG94-11

Clover Clippings as Replacement for Chicken Litter in Compost

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Background

One of the elements of sustainable agriculture is reduction or elimination of off-farm inputs while maintaining soil productivity. A four-acre organic garden in Alabama has been enriching its soil with living mulches of clover and with compost which has depended on purchased chicken litter as the main nitrogen source. For a number of reasons the owners are questioning the sustainability of purchased chicken litter in the organic production system. The reasons include contamination risks, economic feasibility, transportation problems and other practical considerations.

Objectives

1) Compare clover clippings with poultry litter as a nitrogen source for compost in terms of handling, cost, and quality of compost as a complete fertilizer for organic vegetable production.

2) Determine the best carbon source for use in clover compost.

3) Determine if the fertility needs of a vegetable garden can be met by mowing and composting the clippings from a living mulch of white dutch clover growing in 2 1/2 foot strips between the three foot vegetable beds.

4) Host a field day to demonstrate clover composting to other growers and agriculturalists.

Approach

The project will evaluate the use of clover clippings to replace chicken litter as the nitrogen source in compost. Normally the entire garden is planted with White Dutch Clover. At planting time it is tilled into the beds but left growing in the walkways where it protects the soil from erosion and compaction, retains moisture, provides habitat for beneficial insects, suppresses weeds and adds nitrogen and organic matter. The crops are fertilized with compost made from organic matter (including clover clippings) produced on the farm plus purchased chicken litter.

For project purposes two compost piles will be maintained for one year. One compost pile will be made with chicken litter. The nitrogen source for the other compost pile will be clover clippings. The goal is to produce soil fertile enough to grow vegetables without the use of off-farm nitrogen.

Outreach

Evaluation of the two compost methods will be done through nutritional and economic analysis. Nutritional analysis will include tests for major and minor plant nutrients and trace elements. The two compost piles will be compared for qualitative differences based on that analysis. The expense of the two compost piles will be calculated including the purchase of materials and the cost of labor.

A field day will serve as the primary educational event where composting with clover clippings will be demonstrated to growers and agricultural experts. Written reports will be submitted to state, regional and national publications for conventional and non-conventional growers. Presentations will also be made to the Alabama Organic Fruit and Vegetable Growers Association, the Rodale Institute's Mid-South Farmers Network, and the Southern Sustainable Agriculture Working Group.

Project Area:
Organic vegetable production.

Project duration
1 year

Budget:

SARE/ACE	$ 6,160
Matching	$ 6,040

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Southern Region

Annual Report
Project PIG94-12

Swine Lagoon Management System

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Background

According to information from the Department of Environment and Conservation more than 85% of operating lagoon systems in West Tennessee are out of compliance with EPA guidelines. In Dresden County, where there are more than 80 swine and dairy lagoons, most are operating out of compliance. A waste management association has been formed to provide pumping equipment, but it cannot meet the needs of even 25% of available clientele. The existing lagoons are generally 10 years of age or older, with little upgrading in the recent past.

Most (if not all) of the swine lagoons in West Tennessee are in danger of being shut down from point source pollution, which would mean the end of an industry that grosses $40 million per year for a four-county area. Most producers are not convinced of the financial validity of investing in equipment that will allow them to comply with the regulations that will keep them in business.

Objectives

1) Design a swine waste lagoon system to meet or exceed EPA guidelines.

2) Utilize lagoon effluent for irrigation and to provide acceptable levels of nutrients for intensive no-till cropping systems.

3) Maintain record keeping and cash flow program calculations, and monitor soil nutrient levels.

4) Host a field day to demonstrate lagoon management practices.

Approach

This project will demonstrate how to utilize lagoon effluent to provide acceptable levels of nutrients and irrigation for increased yields in intensified, no-till cropping systems while protecting surface and ground water. The project will take place on 100 acres of no-till, intensified crop land that is part of a 1,350-acre family farm. A swine lagoon system will be designed to handle the waste from a recently added swine enterprise on the farm, which will expand from 85 sows in 1994 to 170 sows in 1995.

Project investigators will design the lagoon system in cooperation with state and federal regulatory agencies. The lagoon itself will be oversized in order to allow for winter storage of effluent, something that was overlooked in the design of many existing systems and is now causing problems for the producers. The participants intend to demonstrate that the cost of adopting environmentally sound waste management practices in order to comply with the law can be offset by increased yields and reduced fertilizer inputs.

Outreach

The economic success of the lagoon system will be evaluated by an agricultural economist who will summarize records of cost analysis and field by field crop yields as well as nutrient level yield challenges to validate expenditures.

Several on-farm field days are planned to demonstrate the system and encourage more cooperative planning among agencies and producers to adopt these lagoon management practices. The generated information will also be used in Extension publications.

Project Area:
Waste management

Project Duration:
1 year

Budget

SARE/ACE:	$10,000
Matching:	$ 20,550

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Southern Region

Annual Report
Project PIG94-13

Plant Shelters to Extend the Growing Season for Herbs

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Background

A limited growing season in the mountains of western North Carolina prevents the production of quality herbs beyond the summer months. The region produces high quality herbs, but the limited growing season forces growers to become only part time producers with diminished opportunities for financial return. The normal growing season for herbs, June through September, is also the period of highest labor use and lowest price return for their labor.

Few small producers can afford the initial investment or operational expenses of greenhouses. A solution to this barrier is the development of small scale, affordable and portable plant shelters to extend the growing season of specialty crops in the mountains.

The growing season of several herb plants can be extended (through the use of shelters) from the late frosts of April and May to the early cold snaps in September and October. Portable shelters placed in the fields at planting time could sustain a growing season of eight months instead of four months. Such an extended season has the potential to triple the income from a given number of plants or production area due to premium prices being paid during months that herbs are usually not available.

Objectives

1) Develop and test plant shelters designed to extend herb growing season.

2) Host a field day and/or workshops to demonstrate the use of plant shelters to extend herb growing season.

Approach

The project will develop shelters that are lightweight; portable; inexpensive to construct, maintain and store; easy to operate, energy efficient and re-usable for several seasons. The shelter system will also have a drip irrigation component to accommodate the extended growing season and periods of drought.

The success of the shelters will be measured by the extended length of the growing season, the increased supply of herbs harvested and sold through the market cooperative and the financial return to the farm. Records will be maintained to demonstrate the cost effectiveness of the shelters and irrigation system.

Outreach

Outreach will be handled through documents prepared by the Mountain Horticultural Crops Research and Extension Center. There will also be farm demonstrations with local Extension agents, a workshop for interested farmers and reports in the newsletters of the North Carolina Herb Association.

Project area
Organic production

Project duration
1 year

Budget:

SARE/ACE	$ 3,550
Matching	$ 3,350

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Annual Report
Project PIG94-14

Cut Flowers as a Sustainable Agriculture Alternative

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Background

The most recently available figures (1989) indicate Oklahoma revenue from cut flower sales reached over $9 million that year. Of this, only $300,000 was produced in Oklahoma. National wholesale production of cut flowers and greens is estimated at over $560 million per year. Production of specialty cut flowers (all species except roses, chrysanthemums and carnations) is a rapidly growing section of the cut flower industry.

Many cut flowers are imported into the region from foreign countries. The Mississippi State publication *Inventory of Non-traditional Agricultural Commodity Activities in the Southern Region* (1990) lists only three references to floriculture and production; they are located in Kentucky, Mississippi and Washington D.C. In Oklahoma the diverse soil and weather conditions and the long growing season would allow production of numerous cut flower species, ushering the small farmer into heretofore untouched markets.

Many small farm operations in Oklahoma are experimenting with sustainable crop alternatives to their conventional crops. Berries, herbs, legumes and organic vegetables have proved to be popular sustainable alternatives to corn, wheat and cattle. Cut flowers typically are not among the crops considered for agricultural alternatives. Production literature, research and essential start-up information about cut flowers is virtually unknown in Oklahoma.

Objectives

1) Develop a one-acre prototype of a mixed-species specialty cut flower production system.

2) Test the use of rye and other winter cover crops as a nitrogen source and as companion plants for specialty cut flowers.

3) Develop "how-to" materials about the incorporation of cut flowers into sustainable farming systems.

Approach

This project will demonstrate a cut flower production system prototype to educate farmers about the most efficient and effective approaches to biological pest control, crop rotation, winter cover crops for increased fertility, water quality, erosion and runoff control, inexpensive adaptation of existing farm buildings and equipment, species selection and marketing options.

The project's one-acre prototype is located on a 200-acre farm that has concentrated on winter wheat, milo, alfalfa and cattle. The prototype will gradually acquire more acreage each year, not to exceed 50 percent of the farm so that neither the cut flowers nor the conventional crops will dominate.

The one-acre flower farm will accommodate woody plants such as pussy willow, lilac, butterfly bush and forsythia; annual and perennial flowers; bulbs and groundcovers such as ivys and lily of the valley. The species were selected to allow year-round harvesting, with many species harvestable three months of the year. The latest research will be distributed through Oklahoma State University, the Specialty Cut Flower Association and ATTRA to keep project participants up to date on the best methods for raising cut flowers in a sustainable system.

Outreach

Outreach will take the form of field day, "how to" papers sent to ATTRA, and an Extension fact sheet. The participants will also speak or give seminars at national and regional meetings of the Specialty Cut Flower Association.

Project Area:
Alternative crops

Project Duration:
1 year

Budget

SARE/ACE	$ 6,000
Matching	$ 3,100

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Southern Region

Annual Report
Project PIG94-15

Farmer to Farmer Transfer of Knowledge about Rotational Grazing

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District Conservationist

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Soil and Water Commission
Appropriate Technology
Transfer for Rural Areas

Project Area:
Management-intensive grazing systems.

Project Duration:
1 year

Budget
SARE/ACE: $ 9,988
Matching: $22,133

Background

There is a need for more practical information for producers who are considering management intensive grazing as an economically viable, environmentally sound alternative to purchased feed inputs. Producers often communicate more effectively with other producers than do the conventional agricultural information servers. Producers often have a higher credibility standing with other producers than do the conventional agricultural information servers, particularly when the subject matter represents a departure from the norm or "old way of doing things."

Objectives

1) Hold quarterly farm meetings to discuss management intensive grazing and to share observations regarding different grazing systems.

2) Establish transect lines (in at least one managed area on each farm) to be used for baseline and comparison measurements throughout the study.

3) Condition score cattle quarterly to evaluate the quality of the forages as feedstuffs.

4) Utilize NIRS fecal sampling to assign feed value to forages utilized in management intensive grazing.

5) Share research results at conventions and meetings, and host one field day at a cooperating farm to demonstrate management intensive grazing.

Approach

The four participants of this project are forming a network to fill the various information gaps in their operations. Three of the participants have seven, three and two years experience, respectively, in management intensive grazing. The fourth participant is launching a grazing program in conjunction with the start of the project. They intend to share knowledge from their own experiences, computer programs, videos and publications in 16 meetings during the project year to help each operation attain the highest quality forage at the most economical expenditure of money and labor.

Outreach

Evaluation of the forages will be done through extensive testing of soils, animal condition, plant tissues and manure to come up with a feed tag value similar to purchased feed, including values for crude protein, digestible organic matter and essential trace minerals.

Outreach will be handled through field days, presentations at agricultural meetings and articles in publications. The dates of the 16 scheduled meetings will also be made public for interested people who would like to attend.

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Annual Report
Project PIG94-16

Clover Cover Crops, Weed Management and Consumer Tolerance to Insect Damage

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Background

This project addresses three questions that have arisen naturally from a diversified family farm operation that sells to 50 regular customers and through a food co-op of 300 members.

1) Can crimson and subterranean clover be used to replace synthetic fertilizers and reduce erosion? Which clover is better?

2) How much insect damage will consumers tolerate when they purchase vegetables for home use?

3) How effective are weed management alternatives to synthetic herbicides for vegetable production and sustainable farming practices?

Objectives

1) Compare crimson with subterranean clover as a cover crop and green manure crop for broccoli, crowder peas and sweet corn.

2) Conduct a consumer survey to define potential market for the insect-damaged crops, and test different insect management practices that correspond to survey results.

3) Test alternative weed management strategies and compare the weed control efficacy and costs associated with the use of mulches, hand-weeding and herbicides.

Approach

The two clovers will be planted in separate 1/4-acre terraces in the fall and tilled under in the spring two weeks prior to transplanting broccoli and planting crowder peas and sweet corn.

A local food co-op will survey their 300 members on willingness to buy sweet corn with earworms, crowder peas with stings from cowpea curculio and broccoli with worms. Information obtained from the surveys will be used to determine the extent of insect management necessary for each crop. Concurrent cropping experiments will compare the amount of insect damage on crops with no synthetic insecticide to the amount of damage on broccoli treated with Dipel, sweet corn treated with Sevin and peas treated with Thiodan.

The weed management tests will compare 20-foot sections of 200-foot rows that use grass mulch, paper mulch, herbicide in reduced amounts, hand weeding or no weed control.

Evaluation of the various techniques will be accomplished by comparison of yield, cost and return for each treatment.

Outreach

Outreach and education will take place on at least one field day per year. A fact sheet will be prepared and distributed. The participants will be available to present slides and talks to grower groups and other interested people.

Project Area:
Cover crops, weed mananagement and consumer survey

Project Duration:
2 years

Budget
SARE/ACE $ 4,710
Matching: $5,918

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Southern Region

Annual Report
Project PIG94-17

Shrimp Polyculture on Existing Farms

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Background

For family farms to survive and grow, alternative income opportunities must be found. Although universities are working on sustainable agriculture opportunities, ideas that work well in a research system are often impractical when applied to the family farm. Freshwater shrimp polyculture research has been confined to university level trials with astounding production success, but little information has been gathered as to the economics, practicality or commercial product utilization of freshwater shrimp as a farm product. This project will apply the university level research to demonstrate an on-farm shrimp culture.

Objectives

1) Establish a freshwater shrimp production system in an existing farm pond.

2) Collect water quality, production and cost data on shrimp production systems.

3) Host a field tour to demonstrate the integration of shrimp production into sustainable agriculture systems.

Approach

On a 93-acre swine and beef farm, one of three existing livestock ponds will be used to demonstrate that raising shrimp can provide extra income and not affect the pond's ability to provide stock water. Depending on water analysis and oxygen flow, the shrimp may be raised alone or in conjunction with catfish or paddlefish. A ram pump will be used to provide water circulation and will pump overflow water to a livestock tank. Should water testing indicate an excess of nitrogen or mineral build up after each turn of shrimp, the pond sludge will be pumped for use as fertilizer on adjacent pastures or hay fields. Market research on the economic viability of freshwater shrimp production will also be conducted. An additional aspect of the proposal is market research and development since there is no market for fresh water shrimp in Kentucky at the start of the project.

Outreach

Education and outreach will be accomplished at the annual farmer field day which usually draws 200-300 producers. The farm has been used in the past for demonstration plots to train County Extension agents in no-till alfalfa. It would be made available by the owners for such training in small scale aquaculture. Budgets and results will be made available to magazines and meetings of such groups as Southern Ag Workers.

Project Area:
Alternative crops

Project Duration:
1 year

Budget
SARE/ACE: $ 3,109
Matching: $ 1,850

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Southern Region

Annual Report
Project PIG94-19

Biological Control of Flower Thrips in Pepper Fields

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Objectives

Since 1989, *Thrips palmi* and western flower thrips have become established in parts of south Florida. It is predicted that *Thrips palmi's* range will extend north into Georgia and west to the Pacific Ocean. Pepper plants are preferred hosts and suffer devastating losses when the thrips are uncontrolled. Insecticides do not work well against these species of thrips, resistance is already a major problem. Also conventional insecticides that can be used for control are known to eliminate beneficial insects such as minute pirate bugs and parasitic wasps which play a key role in managing thrips and other pests such as armyworms. Accordingly, nearly all of the nation's winter pepper crop is at risk. Moreover, while peppers are a preferred host, other high value crops are at risk as growers face the problem of controlling these thrips without setting off secondary pest problems or accelerating resistance in other species.

The specific objectives are to:

1) Monitor, collect and identify, on a twice-weekly basis, fields and nurseries to determine insect (damaging and beneficial) populations.

2) Test alternative pest management strategies. Compare costs, crop yields and crop quality of traditional commercial insect control practices to alternative, biological control practices.

3) Test the use of the predatory nematode *Steinernema carpocapsae* as a biological control agent for thrips.

Approach

This project will take place on a farm that raises 225 acres of green peppers each year along with 100 acres of squash and cucumbers. The participants aim to develop and demonstrate a sustainable pepper pest management program based on detailed knowledge of the pests, beneficial organisms and how management practices affect them all. Intensive monitoring (twice a week for 18 weeks) of pests and beneficial organisms will be the basis of the project. Comparisons will be made between plots treated with beneficial organisms such as predatory mites and parasitic nematodes, plots treated with alternative pesticides such as soap, and plots treated with conventional pesticides.

Evaluation will be based on the populations of thrips, other pests and beneficials on all parts of the farm. Crop yield and crop quality will be compared between the standard commercial parts of the farm and the biological control plots. Records of costs and return will be analyzed to determine the strategies that seem most cost effective.

Outreach

Education and outreach will be accomplished by a report presented at an Extension meeting or other suitable forum. A crop consulting firm will incorporate the results into their future control programs for other growers.

Project Area:
Biological control

Project Duration:
1 year

Budget
SARE/ACE: $ 9,950
Matching: $ 10,900

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SOUTHERN REGION

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